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Editorial Notes

Combustion Characteristics

THIS year's Report of the Joint Research Committee of the Institution and Leeds University on the combustion characteristics of town gas is another example of the painstaking and thorough work of Mr. J. W. Wood and his collaborators at Leeds, and another example of the value of co-ordinating the results of different investigators attacking the same problem. The report gave the conclusions drawn from a careful examination of the aeration test burner and was largely concerned with constructional details of the burner and methods of calibration. At first sight it might seem that the report does not show a marked advance in our knowledge of combustion characteristics; but improvements have been effected in the burner, and it is obviously desirable to start with an instrument which, if not perfect, gives a reasonable degree of accuracy and reliability. Modifications in the burner have been made, and no doubt many more could be made. We could go on and on with this precision work, but the time has come to call a halt and try to discover what useful correlation can be established between the behaviour of a gas supply in the test burner and in the burners of gas appliances. We are glad that Mr. Wood is turning attention to this aspect. After all, as Mr. Masterman pointed out at the Institution meeting, a ludicrous situation would arise if every now and then a new set of A.T.B. numbers was established—the necessity of converting one set of numbers to those obtained on the previous instrument, and then to those on the one before that, and so on.

The report stated that the suitability of the aeration test burner is still *sub judice;* but some 50 of these burners have been purchased by undertakings and put into use in various parts of the country, and the utility of the results obtained through their use will be all the greater if the recommendations regarding their use, set out in the report, are followed. Again, we would add to the request made at the meeting that the results of experience with the burner which are being accumulated in different parts of the country should be communicated to the Joint Research Committee. In this connexion the report had a reference to the results of A.T.B. number control at Bournemouth which we published in our issue for May 11 last, which work, instituted because of frequent complaints of the seeming maladjustment of appliances—in spite of the gas being of reasonably constant calorific value and specific gravity—has had a most successful outcome. There it was found necessary to take special measures to maintain a uniform aeration test burner number, but the Bournemouth Gas Company is satisfied that the effort is well worth while. On the other hand, the report put forward evidence to show that the production of gas within close limits of aeration test burner number does not necessarily involve special supervision. Indeed, the figures given in the report relating to Leeds gas show that the supervision normally exercised in producing gas to a uniform calorific value may also produce gas within the desired aeration test burner limits. Actually the staff at the Meadow Lane Works of the Leeds Gas Department had no knowledge of the A.T.B. number of the gas which was being sent out until the tests, which were made daily from May to July of this year, had been completed. And in introducing the report Mr. Wood remarked that a further three months beyond those reported showed the same consistent working. It would be interesting to have the figures for the winter peak periods and to know whether the same uniformity is observed.

The Rôle of Hydrogen

THERE is no doubt that Mr. Wood is an exceptionally skilled experimentalist, and the report will undoubtedly be of great service to others working in the same field. During the discussion much was said about the calibration of the aeration test burner. Both Professor Newitt and Mr. F. O. Hawes suggested the use of a mixture of pure gases as a standard, but Mr. L. T. Minchen pointed to the difficulty of obtaining a really accurate mixture of pure gases, and because of this a gas of known specific gravity is employed at Watson House,

and the air-gas ratio of the burner is measured. At the same time it would appear that a still better method should be introduced. A severely practical note was sounded in the discussion by Mr. A. Forshaw, who, having complimented all concerned on the extreme accuracy at which they have been working, mentioned that gas appliance manufacturers are given a limit in the works to which they must keep of something between 60 and 90 A.T.B. number in the burners they must reproduce for the public.

That section of the report dealing with the effect of adding various constituents to Leeds town gas interests us very much indeed. We note particularly the effect of adding hydrogen. This gas, of course, has a high rate of flame propagation in mixture with air. Despite this, however, the effect of its addition to the aeration test burner number of town gas has been shown to be comparatively small. Does this provide a clue to the maintenance of a reasonably constant A.T.B. number of the district gas even when very substantial use has to be made of water gas plant to meet heavy winter peak loads? Will it resolve itself into a matter of so operating water gas plant as to make a gas rich in hydrogen and low in carbon monoxide? To what extent it is desirable to restrict gas making flexibility to ensure a gas of reasonably uniform A.T.B. number we do not know. Doubtless the coming year's work in the attempt to correlate the performances of appliances with the aeration test burner readings of the gases supplied to them will shed light on the question. In any case any increased cost of gas manufacture must be balanced by savings in maintenance and adjustment of appliances and a more uniform standard of service. The happy mean can be arrived at only by the closest co-operation of the making and selling sides and an appreciation of each other's difficulties. The aim of the Industry is to give good service coupled with cheap gas; it also serves all sections of the community, and the vast majority of its consumers have small incomes, which makes all the more essential the co-operation of which we have spoken.

Reducing Gas Making Costs

THERE can be no doubt that the welding system for the repair of retort leakage described in the Institution Paper by Messrs. Rhead, Hawthorn, and Deacon is a most important advance in the technique of the maintenance of continuous vertical retorts. The system of hot patching by blow-pipe spray welding has been evolved only after a great deal of thought and endeavour in the overcoming of practical difficulties, and the successful outcome is a tribute to the perseverance, ingenuity, and skill of all concerned. Further development work is in hand for perfecting and extending the application of the process, and to that extent the Paper was in the nature of a progress report; even so, the success already achieved is such as to warrant widespread adoption of the method. At Birmingham the process has been in use for eight months on two continuous vertical ranges, one making 10 million cu.ft. per day and the other 2 million cu.ft. The repairs effected have made it possible to postpone cold repairs which would otherwise have been necessary, and the cost of hot repairs has been halved compared with the previous cost of repairs using cold materials. There was no criticism of the Authors' contention that the process offers an efficient and practical method of preventing the growth of leaks providing it is applied soon after leakage commences to show. In these circumstances there is every promise of effecting substantial reduction in the cost of retort maintenance. Settings usually have to be reconstructed long before the greater part of the refractories are worn out, involving considerable wastage of material and labour. The process of hot repair should result in considerable savings in the cost of refractories per ton of coal carbonized.

The new process has added significance owing to the growing popularity of the upwardly heated vertical retort. The great reduction in spalling which has accompanied the change in the method of heating should enable a life of an extra year or so to be obtained with the upwardly heated type. The latter, however, is prone to leakage in the lower part of the retort. At the Institution meeting Mr. G. C. Pearson explained how at Birmingham, after twelve months' work, leakage had developed in a setting of upwardly heated verticals to such an extent that immediate repair had to be considered. Actually arrangements were made to carry out the work. Then came the advent of the new welding process, and the repair programme was postponed. Hot patching was applied successfully, and at the present time the work is in splendid condition and giving the best thermal results in the Department.

One must, of course, look upon this question of leakage in perspective. For localized leakage the welding process is the most effective method to apply, when, for example, there may be three or four localized leaks in a retort. Its success in the repair of localized leaks has been amply demonstrated. If, remarked Dr. E. W. Smith in the course of the discussion, the hottest zone of an upwardly heated retort be taken as 8 ft. high the number of joints in this area in continuous vertical retorts capable of making 16 million cu.ft. of gas a day is approximately 72,000; and of these about 5,000 are available at any time for examination while the retorts are scurfing. Of these 5,000, about 14, it would appear from the Paper, are attended to each day by the welding process. At the moment then, it has limitations when attention has to be paid to a large number of joints showing tendency to leakage, which joints may be effectively sealed by normal wet spraying methods.

However, the Authors of the Paper suggested that, with suitable development of the welding process, it should not be technically impossible to achieve such results as the building up of wasted, spalled, and flaked zones, the facing of refractories with special coatings and glazes, and the elimination of joints where desirable. Undoubtedly an ambitious programme. However, whatever the outcome—and it is to be hoped that it will be successful—it is at present generally recognized that the life of a vertical retort setting is much reduced by each cold shut-down; and by the use of the hot welding process as at present developed the periods between shut-downs are sure to be extended, and therefore the ultimate life of the retorts increased. The cost of repairs is an important item in the balance-sheet, and the new process, which should reduce this cost, is to be warmly welcomed.

Alternative Processes

Two distinct lines of attack in the production of hydrocarbons from coal are being pursued by Dr. Dent at Leeds and by Dr. King at the Fuel Research Station. Dr. Dent speaks of the production of 500 or 600 therms per ton of coal treated under pressure in hydrogen, which is not a very cheap gas. Dr. King is concerned with the action of catalysts on hydrocarbon production at normal pressures. Both investigations have yielded a great deal of information and have shown the technical potentialities of each. In this regard Dr. Dent's work has been quite startling and has aroused enormous interest; it is to be continued, it is hoped, on a larger scale and

in collaboration with the Fuel Research Board. It would appear, however, that Dr. Dent is uncertain as to which of the two processes will in the long run prove the more expedient or desirable. We quote the following from his contribution to the discussion on Dr. King's Paper at the Institution meeting:

"As we now picture it, a hydrogenation process for the production of gaseous hydrocarbons is vastly different from the hydrogenation process for the production of liquid hydrocarbons, and it seems that if a works were laid out to produce relatively widely varying amounts of both gaseous and liquid hydrocarbons by hydrogenation, it would always have a considerable part of its plant lying idle, and so defeat the aim of utilizing off-peak load facilities. On the other hand, when synthesizing hydrocarbons from carbon monoxide and hydrogen, variation from a gaseous to a liquid product will mainly be a matter of regulating the temperature of the catalyst chamber with little requirement for additional plant."

This analysis of the situation, though clear, indicates that we are a long way from arriving at a practical and commercial solution of the problem. At the moment we have these two processes, which we can conveniently call the Leeds and the Fuel Research Station processes. "Only thorough investigation," said Dr. Dent, "will tell us which of the processes, or whether a combination of the two, will be most usefully applicable to the Gas Industry." Thorough investigation, it will be agreed, must proceed. But the discussion does emphasize once again that, whatever the outcome of the investigation, we must in the meantime leave no stone unturned in perfecting our organization for selling town gas as now understood and, equally important, our organization for selling coke.

Coke and the Open Fire

A GOOD deal of work has been carried out of late on the relative efficiencies of smokeless solid fuels in the open fire-grate. We have had at the Institution meeting this month the Paper on the subject by Dr. Davidson and Dr. Hartley, who, as a result of extended and carefully carried out investigation arrived at the conclusion that of all the smokeless fuels, including anthracites, steam and bituminous coals, and low-temperature coke, high-temperature gas coke gives the highest radiant efficiency and shows marked economy. The week following publication of the Paper came another on the same subject by Dr. Margaret Fishenden. It was read before the Institute of Fuel, and a report of the discussion will be found in our issue to-day.

As a result of her experiments, Dr. Fishenden contended that South Wales coals are in every way suitable for use in open grates designed for burning gas coke. The radiation emission, she said, was in all cases higher for the coals than for the cokes, on the average the advantage being about 1% over the best quality open-fire coke and 16% over the other cokes. Now Dr. Fishenden's comparisons were based on radiation taken in one direction only, a method which is surely open to criticism; and we think that to experiment with an open fire "mixed" coke having a moisture content of 5% and an ash content of 14% is, to say the least, a little hard on open fire coke as sold to-day. It is not the purpose of this note, however, to discuss technical details; and we are quite sure that Welsh smokeless coals can be burned satisfactorily in the gas ignited coke grate. But we would call attention to that all-important item, cost. At the prevailing prices in London dry steam coals are 41% more expensive than open fire coke and anthracite is 43% more expensive; and making a conservative allowance of 5% for breakage dry steam coals would be at least 48% and anthracite at least 50% more expensive than coke. With coke demonstrably satisfactory in the special coke burning grate, is it to be expected that the consumer will pay half as much again to burn smokeless coal?

Smokeless Housing Schemes

Nearly four million new dwellings have been built in Britain during the past twenty years. In this period an expenditure of at least £750,000,000 from public funds has been involved in the dwellings built with Government subsidies. These points were mentioned in a Paper by Miss Elizabeth Denby last Friday at a meeting under the auspices of The Institution of Gas Engineers at the Public Health Services Congress; and the Author asked whether much more value for money would not have been obtained if these dwellings had been rendered smokeless. The Author, in common with ourselves, has only one answer. Smoke abatement is bound up with the economic needs of the workers, their health, and their happiness. Yet practically every house erected since the war is a smoke-producing dwelling in which raw coal is burned. Heating and cooking equipment has been fitted which causes the housewife unnecessary labour and inconvenience. Estates have been developed in areas formerly practically free from smoke but which now "enjoy" a healthy sootfall. Yet the combination of gas and coke offers, at lower cost than raw coal, the advantages of convenience, comfort, smokelessness—and labour-saving. There is no doubt whatever that the rational use of smokeless fuel should be exploited to the full in new housing estates. "Up to the present," said Miss Denby, "the traditional view of what every woman is supposed to want has prevailed over the more sensible one that she cannot know what she wants until she knows what is available." The Gas Industry must press upon local authorities the available alternatives and encourage housewives to demand these alternatives to dirt and labour. Every woman must surely want more leisure from unnecessary work, less smoke and ugliness. The Gas Industry, in meeting the needs of families with little money, can increase at the same time the amenities of the districts in which its aid is invoked. The smokeless home, through gas and coke, would be a welcome change from what Miss Denby spoke of as "the prevailing concentration on destruction."

Public Health Service

In our reference to Miss Denby's Paper we have not dwelt on the health aspect of the employment of smokeless fuels in place of raw coal, but the Gas Industry has contributed in no small measure to the health of the people of this country—and, given the opportunity, it could obviously do a very great deal more. At the same meeting of the Public Health Services Congress Mr. W. L. Howe, of the Nottingham Gas Department, gave a Paper illustrating some of the many directions in which gas has helped, particularly in the last decade, to bring about healthier conditions. He gave examples of the ways in which gas is being used by public authorities in schools, municipal offices, swimming pools, baths and wash houses, sports pavilions, hospitals, and so on. These developments have been made possible by supplying gas at special rates for large-scale uses. Attractive tariffs were introduced at Nottingham five years ago. To-day there are over 250 gas-fired boiler installations in the area, every one of which is contributing its quota to the abatement of the smoke nuisance. By banning the use of raw coal, hospitals and public institutions would be taking an encouraging preventive measure against ill-health. Mr. Howe also illustrated the use of gas in factories, bakeries, and crematoria. Pointing to the opportunity which the public health services have of setting an example to the rest of the community by the provision of smokeless fuel in the buildings which come under their control, he observed that, if a problem appears at first sight to be an unsuitable instance for the use of gas, or the local gas undertaking is unable to provide immediately the information required, this information can be obtained through

the medium of the Gas Development Centres. And this, of course, emphasizes once again the need for 100% membership of the Centres.

The First Ten Thousand

Congratulations to the Women's Gas Council on passing the first ten thousand. This is a remarkable achievement for an organization which is not four years old; yet it typifies that spirit of youthfulness and progress which has marked the development of the W.G.C. since its inception. To Manchester has fallen the distinction of enrolling the ten thousandth member, and this noteworthy event was suitably celebrated by presenting her with a clinical gas lamp. The presentation was made by Miss Grime, a Vice-President of the Branch and ex-Lady Mayoress of Manchester.

We are confident that the attainment of this outstanding landmark will bring no recession of effort on the part of the W.G.C. Rather, we think, will it encourage the re-doubling of activity between this milestone and that which will mark the next ten thousand. It will mean the intensification of the Council's invaluable work of enlisting the interest and support of the Gas Industry's principal customers. As we have said on previous occasions, there can be no better means of establishing an interested and contented body of consumers than to band them together in an organization which not only keeps them *au fait* with the many ways the Industry can help them personally, but also gives them the opportunity of participating in the activities of a movement which is concerned with vital social services and work of benefit to the community as a whole. We would reiterate our appeal to all centres in which branches of the W.G.C. have not yet been established to do all in their power to bring about the formation of one, and thus join with the fifty or so branches which already exist in pushing forward towards the next ten thousand.

Personal

Sir Frederick West's Jubilee

The Directors, officials, staff, and workpeople of West's Gas Improvement Company, Ltd., assembled with their wives at a Dinner given at Belle Vue, Manchester, on Friday, Nov. 18, 1938, at the invitation of Sir Frederick J. West, to celebrate his 50 years' association with the Company, of which he is now Chairman and Managing Director. Nine hundred guests were received by Sir Frederick and Lady West.

Mr. W. A. Valon, M.Inst.C.E., spoke in warm terms of the "captain of the team" in tendering the congratulations of the Company's Directors; Mr. P. C. Shapley, A.M.I.Mech.E., Works Manager, conveyed the good wishes of the officials; and Mr. W. Davidson, an employee in the structural steel department, who holds the office of Joint Chairman of the Works Committee, expressed the loyalty and affection of all employees for "The Chief" and presented to him an illuminated volume containing all their signatures.

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Mr. J. BROOMHEAD has been appointed to succeed his father, the late Mr. T. H. Broomhead, as Engineer and Manager of the Bollington Gas Department. He had been Technical Assistant to the Undertaking for about eight years and in May of this year was appointed Deputy Manager. He is 31 years of age. His brother, Mr. Harry Broomhead, is Manager at Desborough.

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Mr. W. H. BLUNDSTONE, Engineer and Manager of the Newark Gas Department, has been admitted to Associate Membership of the Institution of Chemical Engineers.

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Mr. T. E. PARRY, Deputy-Engineer to the Bingley U.D.C. Gas Department, who has been appointed to the position of Engineer and Manager of the Fleetwood Gas Company, was presented on Thursday evening last, from the staff and employees of the Bingley Gas-Works, with a set of golf clubs. The presentation was made at a Social Evening held at the Brown Cow Inn, Bingley, by Mr. J. B. Balmforth, Engineer and Manager, who paid tribute to Mr. Parry's abilities. The Chairman of the Committee and several others spoke highly of Mr. Parry and conveyed their good wishes, and he was given a hearty send-off by all present.

Forthcoming Engagements

November.

25.—Southern Association.—General Meeting, Hotel Victoria, Northumberland Avenue, W.C. 2, 2.15 p.m. Paper by S. F. Dunkley on "Quality Control and a System in Operation." Committee Meeting, 11.45 a.m.

25.—London and Southern Juniors.—Annual Dinner and Concert, Empire Restaurant, Victoria, S.W. 1.

26.—Scottish Western Juniors.—Visit to Greenock Corporation Gas Department.

December

1.—Midland Juniors.—Paper by F. A. C. Pykett, "The Distribution of Gas at Coventry."

2.—I.G.E.—Joint Committee on Complete Gasification under Pressure, 3 p.m. (*Transferred from Dec. 8.*)

3.—Manchester and District Juniors.—Meeting at Blackburn. Paper by E. B. Field on "Advantages and Disadvantages in the Production and Distribution of a Low-Quality Gas."

5.—I.G.E.—Research Executive Committee, 10.30 a.m.

7.—London and Southern Juniors.—Visit to Neasden Works of Ascot Gas Water Heaters, Ltd.

10.—Scottish Juniors.—Joint Meeting at Glasgow. Address by Sir Frederick West and Visit to Provan Chemical Works.

10.—Yorkshire Juniors.—Visit to H. C. Slingsby, Ltd., Keighley.

12.—I.G.E.—Finance Committee, 1.45 p.m.; Membership Committee, 2.15 p.m.; General Purposes Committee, 3 p.m.

13.—I.G.E.—Council, 10 p.m.; Gas Education Executive Committee, 2.30 p.m.

13.—London and Southern Juniors.—Paper by G. Dougill, "A Serious Case of Corrosion and Its Cure."

13.—N.G.C.—Central Executive Board, 2.30 p.m.

15.—I.G.E.—Refractory Materials Joint Committee, 2.30 p.m.

Institution of Gas Engineers

Members of The Institution of Gas Engineers will be welcome at the following Meetings:

The 3rd Hinchley Memorial Lecture of the Institution of Chemical Engineers in the Lecture Theatre of the Institution of Civil Engineers, Great George Street, S.W. 1, on Nov. 25, at 6.30 p.m. The subject of the Lecture is "Fog and Mist from the Physico-Chemical Standpoint" and will be delivered by Professor J. C. Philip, O.B.E., M.A., D.Sc., F.R.S.

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A Meeting of the British Coal Utilisation Research Association at 6 p.m. on Dec. 1, 1938 to be held in the Meeting Room of the Institution of Civil Engineers, Great George Street, S.W. 1. A Lecture will be given by Dr. P. O. Rosin on "Aerodynamics of Domestic Fires," and his Lecture will be illustrated by a film based on the model with which he has been carrying out his researches at the Imperial College of Science, South Kensington.

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A Discussion to be arranged by the Photometry Section of the Illuminating Engineering Society in the Lecture Room of the Junior Institute of Engineers, 39, Victoria Street, London, S.W. 1, on Nov. 29, 1938, at 6.30 for 7 p.m. The subject of the Discussion is "Outdoor Photometry," which will be opened by Mr. J. S. Dow.

Tickets for these meetings can be obtained from the Secretary of The Institution of Gas Engineers.

Members of The Institution of Gas Engineers are reminded that the Symposium on the Measurement of Gas Temperatures is to be held on Friday, Dec. 2, in the Lecture Theatre of the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, W.C. 2. The Symposium, for which a membership fee of 10s., including advance copies of all Papers, is payable, will open at 10.30 a.m., with an interval for lunch from 12.30 to 2.30 p.m., when the Second Session will commence. Tea will be served at the conclusion. Further particulars can be obtained from the Secretary of The Institution of Gas Engineers.

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The attention of members of The Institution of Gas Engineers is drawn to the publication by the Ministry of Health of Model By-laws, Series XXVIII., "Discharge of Trade Effluent from Trade Premises into Public Sewers." Copies, price 3d. post free, may be had on application to the Secretary of the Institution.

News of the Week

For Cooking and Heating Appliances at the Lowestoft Isolation Hospital, the Town Council have accepted the tender of the Lowestoft Water and Gas Company.

Several Prominent Members of the Court Players, who are appearing at the Theatre Royal and Empire, Peterborough, for a season, have accepted an invitation to visit the Peterborough Gas Company's premises.

Pointing Out that the Capital Expenditure would be in the region of £5,000, without any agreed period for the retention of the installation, the Isle of Thanet Gas Light and Coke Company have refused to tender for the re-lighting of the Margate seafront from Northumberland Avenue to All Saints' Avenue.

Work has Commenced on the building of new offices, showrooms, workshops, and demonstration theatre for the Greenock Corporation Gas Department. The premises will cover a large area, most of the building being single-storeyed, with the demonstration theatre on the upper flat at one corner. The work will be completed in March.

A Visit was Paid recently by the Halifax Gas Development Association for Women to the Grappenhall Works of Richmonds Gas Stove Company, Ltd. (Radiation Ltd.). At the conclusion of the visit the Secretary, Mrs. A. M. Chambers, moved a vote of thanks for the invitation to the Works and expressed the keen appreciation of all that the members had seen.

A Lecture and Film Show were held in the Showrooms of the Cannock District Gas Company recently. The films were kindly provided and shown by Messrs. Winn & Coales, Ltd., the lecturer being Mr. Alfred Smith, supported by Mr. S. Boden. The show was well attended and consisted of representatives from Cannock, Uttoxeter, Lichfield, and Rugeley Gas Undertakings. Mr. Charles R. Ingham (Engineer and Manager of the Cannock Company) presided, and thanked Mr. Smith for his very interesting lecture. The films showed emergency repairs to cables, burst mains (gas, water, &c.) and the gas-proof and splinter-proof cellar in the Ottoman Bank, London, and also how to render living rooms proof against the ingress of poison gas in a very simple and quick way. They also showed a method for putting out a burning 9-in. gas main by means of CO_2 and an asbestos bag.

Application Forms and Particulars of the Associate-Membership Examination for 1938, together with the Memorandum on "The Training of a Chemical Engineer," may be obtained from the Hon. Registrar, Institution of Chemical Engineers, 56, Victoria Street, Westminster, London, S.W. 1.

An Interesting Gas Installation is that at the Distillers' Company's offices in St. James' Square (Architects: Messrs. Mewes & Davis). The heating engineers are Messrs. Richard Crittall, and the Crittall system of panel heating is used throughout. Gas boilers supply the heating and domestic hot water. Every room has its own thermostat, and even the corridors are thermostatically controlled. The yearly gas consumption is estimated at 55,000 therms.

A Series of Cookery Demonstrations held recently at Penarth by the Cardiff Gas Light Company, in collaboration with the Parkinson Stove Company, proved to be highly successful. Demonstrations of attractive menus were given by Miss P. M. Allen, *Diplomée*, N.S.T.C.D.S., on the Parkinson "Renown" cooker to good audiences in the afternoon and evening of each day. An exhibition of "Parkinson" appliances was also staged throughout the week. The demonstrations and exhibition are to be continued at the Roath Park Presbyterian Church Hall, Roath.

A Proposal to Provide a New Gasholder of half a million cu.ft. capacity is being considered by the Buckhaven and Leven Gas Commissioners, who have decided to apply for a Special Order with the object of scheduling ground at Leven adjacent to the Central Works for gas-works purposes. Mr. H. A. Aitken, General Manager, reported that the existing holder storage accommodation totalled 490,000 cu.ft. and was divided among four gasholders. The maximum day's output was 684,000 cu.ft., so that the total holder storage available was approximately equal to 17 hours' maximum output. It was an axiom of gas-works practice that holder storage accommodation should be equivalent to the maximum 24 hours' output. The estimate for 17 hours was, however, a high one, as the holder storage available was distributed over so many small-sized units. On the basis of works storage accommodation it was equivalent to approximately 13½ hours' output.

Value of Co-operation in Research

Increase in the use of gas for commercial purposes was commented upon by Mr. J. H. Canning, President of the Wales and Monmouthshire Association of Gas Engineers and Managers, during a visit to the Engineering Exhibition at Cardiff on Thursday of last week.

Mr. Canning and his party were officially welcomed by Major Ivor David, President of the South Wales Institute of Engineers.

The Gas Industry, said Mr. Canning, had its own Research Committee for the purpose of improving the efficiency of the processes, but that Committee could not cover the whole field of research, so that they had to acknowledge indebtedness to other branches of engineering, whose work could be seen year by year in the exhibition.

The Gas Industry had been able to improve the efficiency of various engineering processes, particularly those requiring heat treatment, where gas gave the exact temperature required as well as the exact atmosphere whether for reducing or oxidizing. It also gave a continuously accurate control of the heat, so that any process could be repeated with perfect accuracy.

Mr. H. D. Madden (Cardiff), who also gave an address, expressed hopes for the success of the exhibition.

Major David later extended a welcome to members of the South Wales Branch of the Institution of Mechanical Engineers.

Mr. W. Clark Jackson (Neath), the President, responding, expressed the indebtedness of the Branch for the many kindnesses extended by the South Wales Institute to its kindred societies. The Institute had extended to all the societies the right hand of fellowship, and the Mechanical Engineers were highly appreciative of the work the Institute was doing for South Wales in general by organizing the exhibition from year to year.

Major David said a special welcome was due to the Mechanical Engineers this year because their national President, Mr. David Roberts was a Cardiff man, who was on the Council of the Institute. Welcome was given in addition to members of the British Road Tar Association.

"Flats"

A Book of Distinction

In their publications—whether technical or strictly propaganda—Ascot Gas Water Heaters, Ltd., know no half measures. To both types of publication issued by the firm we have had occasion from time to time to refer in appreciative terms in the "JOURNAL." Their latest effort is a book entitled "Flats." It is superbly produced, lavishly illustrated in quite the best of taste, and most admirably balanced in design. The contents are drawn together in a most polished way and the whole is a happy blending of general and technical information on modern flats and their equipment—and not just gas equipment.

"Flats" appeals to us very much indeed from three main points of view. In the first place it is bound to excite the interest of all concerned with the health and social welfare of the community; secondly, it is sure to prove of value to the architect; thirdly, it gives an arresting and convincing picture of how the Gas Industry is consolidating the gas water heating load. If Ascot Gas Water Heaters stand to gain by this first-class and undoubtedly imaginative effort—and we think they will gain—so, too, does the Gas Industry, for the publication demonstrates vividly and directly that gas water heating, naturally in this instance by the Ascot way, is by no means the prerogative of the more well-to-do. The price range of the flats illustrated is wide, the lower limit being for flats for the working-classes at rents, including rates, of less than 10s. a week. Gas water heating, with all its convenience and absence of dirt can be, and is being, enjoyed by every section of the community.

There is no discordant note of blatancy throughout the 287 pages of "Flats." Ascot's have had a good story to tell, and they have told it in most interesting and attractive fashion, interesting alike to layman and specialist. Propaganda, yes; but of the very best type. It will enhance the reputation of the firm; it will add to the prestige of the Gas Industry; it will foster the gas water heating load and brighten the lives of the people. "Flats" shows the modern way to cheerfulness and comfort with economy.

W.G.C.'s 10,000th Member

It has fallen to Manchester to claim the proud distinction of enrolling the ten thousandth member of the Women's Gas Council. Here we see Miss F. M. Grime (Vice-President of the Branch and ex-Lady Mayoress of Manchester) presenting Mrs. Mervyn with a clinical gas lamp to commemorate this outstanding landmark in the development of the W.G.C.

New Gas-Generator Automobiles

According to the "Russia To-day" Press Service, the Moscow Institute of Research of the Soviet Auto-Tractor Industry (NATI) has constructed several new gas-generator machines to work on local fuel. In conjunction with the Institute of Research in the Peat Industry, NATI has constructed a gas-generator installation for use on vehicles working in peat areas. A few days ago the gas-generator was fitted to a tractor built at Kharkov Tractor Works and is being tested in field work with excellent results.

For coal areas, NATI has constructed a gas-generator installation to work on anthracite, which has undergone successful laboratory tests. A gas-generator of this type is at present being built for the ZIS-5 lorry, manufactured at the Stalin Automobile Works in Moscow.

Special interest attaches to experiments carried out by NATI in the use of the liquid gases butane and propane (by-products of oil-refining) for motor transport. The Institute has constructed an apparatus which makes it possible for automobiles to work on liquid gas as fuel, as well as on benzine. Apparatus of this type have been fitted to a ZIS-5 lorry and a GAZ-AA lorry (the latter built at the Gorky Automobile Works) and tested with excellent results.

Interesting Exhibition at Cambridge

Smoke abatement, cooking, and dietary are the keynotes of a Home Service Exhibition opened at Cambridge on Friday by the University and Town Gas Light Company.

An incidental but extremely popular feature is the demonstration—the first in the town—of the Milnes thermo-electric generator, by which a wireless receiver may be operated by gas.

Mr. G. F. Dale, a Director, who presided at the opening of the Exhibition, referred to the Company's policy of educating the public in the economical use of gas in order to ensure contented consumers. Alderman W. L. Briggs, who opened the exhibition, described its three objects as practical ones both from the point of view of public welfare and personal health, comfort, and happiness. Mr. J. Hunter Rioch (Engineer and Manager) thanked manufacturers for their co-operation and members of the staff, especially Mr. G. E. H. Keillor (Sales Manager), and Mr. C. J. Hunt for their share in the success of the exhibition, and Alderman Briggs for his support.

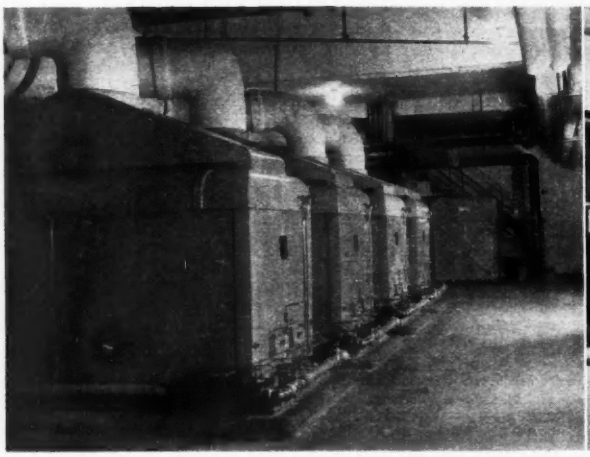
In addition to washing and cookery demonstrations, a novel competition is that in which men, under the critical eye of the ladies, are required to bath babies.

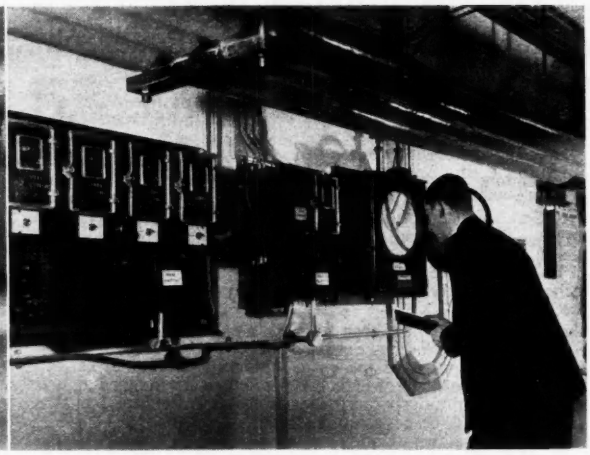
"Gas Calling"

It is extremely encouraging to find another newcomer to the ranks of the gas undertakings' magazines. The present recruit hails from Stockport. Entitled "Gas Calling," the magazine supplies a long wanted medium whereby the Stockport Gas Department and its consumers can come into closer contact. And we feel the Stockport consumers will not be reluctant to appreciate its contents. It is definitely inviting. In a congratulatory message to "Gas Calling," the Mayor of Stockport, Councillor H. Shepherdson, J.P., says that he has been deeply impressed with the magnitude of the work, in all its different phases, undertaken by the Corporation Departments. "As a trading undertaking," he adds, "the Gas Department is one of the largest, and when it is stated that no less a sum than £1,193,000 has been expended on the construction of the works, mains, &c., and that it has over 51,000 consumers and an output of nearly 1,340 million cu.ft. per annum, I think the truth is apparent."

Among many interesting articles is one by Mr. A. M. Paddon, President of the B.C.G.A., on "Publicity."

A 130,000 Therms a Year Installation





A new block of 68 flats over ground-floor shops has recently been completed at Richmond Court, Sloane Street, London. Each flat has points for a gas cooker, gas refrigerator, and gas fires, and the block is centrally heated, with a central supply of hot water from four gas boilers. The Heating Engineers were Messrs. Young, Austen, & Young; and the Architects, Messrs. Joseph.

The two central heating boilers are Potterton "Rex" Series 3 of eight sections each—with a heat output of 1,000,000 B.Th.U./hr. The domestic boiler is a Potterton Series 3, of ten sections, with a heat output of 1,250,000 B.Th.U./hr. The fourth boiler—a "Rex" series 3 of ten sections—acts as a standby for either central heating or hot water supply. The whole installation is, of course, completely thermostatically controlled.

The gas for heating and hot water supply is measured by two meters—9,000 cu.ft. an hour for the central heating, and 6,000 cu.ft. an hour for the hot water. It is estimated that Richmond Court will use about 130,000 therms a year, for central heating and domestic hot water.

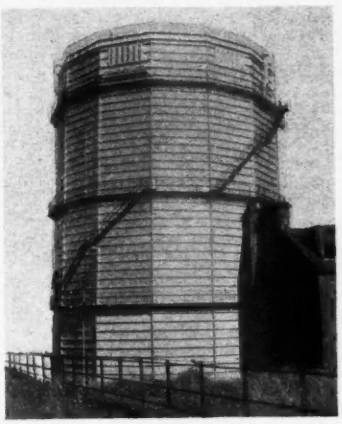
This installation has an additional interest; it is to be used as an experimental plant. Accurate data will be obtained on gas consumptions, heat losses, and so on. There is a complete system of test meters, and the amount of circulating water in the heating mains is continuously recorded, as also are the flow and return temperatures. This information is also recorded for the domestic hot water secondary mains. A water meter in the cold water feed to the calorifiers measures the amount of hot water used.

New M.A.N. Waterless Holder at Kirkcaldy

Inauguration Ceremony

The new M.A.N. waterless gasholder erected for the Kirkcaldy Gas Department by R. & J. Dempster, Ltd., was formally inaugurated on Nov. 18, when ex-Bailie Grieve, formerly Convener of the Gas Committee, turned on the gas before a large gathering.

At a lunch given after the inauguration ceremony by Messrs. R. & J. Dempster, Ltd., Councillor P. M. Henderson, the newly-appointed Gas Convener, presided. Proposing the toast of "Kirkcaldy Town Council," Mr. H. A. Aitken (President of the North British Association of Gas Managers) recalled that 25 years ago he had taken up his first appointment as assistant at Kirkcaldy to Mr. James Kincaid, who was Manager at that time. He was greatly indebted to the Kirkcaldy Undertaking for his own early training. Quite a few gas managers in Scotland and England and abroad owed their success to the fact that they had received their training at Kirkcaldy. He complimented the town on its most recent enterprise. The new holder would prove beneficial both to the Undertaking and to the consumers. He coupled the toast with the name of Provost Wilson.



Provost WILSON, replying, thanked Messrs. Dempster for their hospitality. He wished to acknowledge the great services rendered to the Kirkcaldy Corporation by Mr. J. Kincaid, their former Gas Manager. He regretted Mr. Kincaid's absence that day. He had been active in the proposal to have a new holder. He wished also to mention the name of ex-Bailie William Grieve, who was Convener of the Gas Committee during practically the whole of the period the holder was being erected. The third name he wished to mention was that of Mr. Lefevre, who had been in charge of the work for Messrs. Dempster. The gasholder was to some people a monument, while to others it represented a forward movement on the part of the Gas Committee. Kirkcaldy was satisfied that the decision to put it in its present position was a wise one.

Mr. WALTER MUTER (a Past-President of the British Commercial Gas Association), proposing the toast of "The New Gasholder," said it was the first time he had ever proposed a toast to something inanimate. He commended the Town Council on their wisdom in erecting this holder. They could not afford to lose any opportunity of putting the claims of gas before the public. They should relate these claims to a national fuel policy which must eventually be the policy of the Government. Gas needed to fear no competition from electricity, oil, or any other fuel. It had its own sphere of usefulness. They were seeking no Government subsidy for the maintenance of their Industry. The motto of Kirkcaldy was "Vigilando Munio," and the Gas Industry might well copy it and realize the need for eternal vigilance. He hoped that the new holder would prove valuable to the citizens of Kirkcaldy and to those they proposed to take under their beneficial wing at an early date.

Councillor P. M. HENDERSON, replying, said that none of the gas engineers present would have envied Kirkcaldy Corporation its task during the last year. Owing to the collapse of the Pathhead holder their storage capacity had been reduced to 200,000 cu.ft., and they had a daily output of 1,000,000 cu.ft. He desired to pay a tribute to the loyal and energetic staff they possessed under their young Engineer, Mr. Dow. Some said gas was a thing of the past, but since 1912 their make had risen by 90%, consumers had increased by 53%, while since the opening of their new showrooms in 1933 their sales had gone up by £10,000, an increase of 135%.

Mr. J. M. Dow (Engineer and Manager) thanked the Town Council, Gas Committee, and officials, along with representatives of Messrs. Dempster, for their work.

Ex-Bailie WILLIAM GRIEVE said the work on the holder had been held up, but thanks to the energy of the contractors and their local M.P. they had succeeded in persuading the Government to lift the embargo on the use of steel so that the work might proceed. He proposed the toast of "The Contractors."

Mr. LESLIE WALKER (Manager, R. & J. Dempster, Ltd.), replying, said that M.A.N. holders had been manufactured since 1913 and at the present time 750 million cu.ft. of gas was stored in them. British licensees had made 53 of these holders, of which his firm had produced 26 This holder was the easiest to supervise. It could be kept in order when working and gave the minimum amount of inconvenience and expense. The Kirkcaldy holder stored 600,000 cu.ft. and could be extended to store 750,000 cu.ft. This could be done without interfering with its operation. He hoped the extension would soon be needed.

Mr. J. WINSON SCOTT (Managing Director, R. & J. Dempster, Ltd.) presented ex-Bailie Grieve and Councillor Henderson with silver trays as souvenirs of the occasion, both gentlemen returning thanks.

Mr. DAVID FULTON (Helensburgh) proposed a vote of thanks to the Chairman.

The New Holder.

The new holder is built on ground reserved for works extensions by special powers since 1912, after some controversy locally regarding the site. A reinforced concrete foundation was constructed with a system of curtain walling to convey the perimeter loading down to the rock formation. The maximum load over the area covered by the bottom plates is not more than 100 lb. per sq.ft., while that round the circumference of the walls averages one ton per sq.ft.

The holder is polygonal, with fourteen sides. It is 87 ft. in diameter across the corners and 84 ft. 10 in. across the flats. The height from the foundations to the eaves of the roof is 122 ft., and there are three galleries interconnected by an outer metal staircase. The roof has a specially designed large ventilator, and additional ventilation is obtained by a system of vertical louvres under the roof in every alternate bay. Natural lighting is provided above the piston by roof windows. When full, the holder throws a pressure of 9 in. W.G., increasing to 10 in. when the piston is at its lowest point. British materials were used throughout the contract.

Kirkcaldy's area of supply is 55 square miles, and the Undertaking serves 13,335 consumers. There are 68 miles of mains and the annual make is 293,124,000 cu.ft.

Liverpool's "Radiant House" Visited

On the afternoon of Nov. 16 a large party of delegates from the British Federation of Hotel and Apartments Associations, who are holding their annual conference in Wallasey, and members of the Gas and Water Committee of the County Borough of Wallasey visited Liverpool as guests of the Liverpool Gas Company and inspected "Radiant House" and the Gas Development Centre in Duke Street.

The party, which was conveyed by Wallasey Corporation buses *via* the ferry service to Liverpool and returned through the Mersey Tunnel to Wallasey, enjoyed a most interesting and instructive afternoon, which included a display of the latest B.C.G.A. publicity films and inspections of the special gas equipment for catering and boarding houses. The visitors were subsequently entertained at tea by the Liverpool Gas Company.

Amalgamation and Grouping

Severn Valley and Shrewsbury.

The Directors of the Shrewsbury Gas Light Company have recommended shareholders to accept the offer of the Severn Valley Gas Corporation to acquire the Undertaking. The terms are 130 £1 ordinary shares of the Corporation, credited as fully paid, together with £2 in cash, with the alternative of £147 in cash, for every £100 of the Company's stock. According to the last returns, the Shrewsbury Company, which has now served the town for upwards of a century, has an annual make of some 340 millions. It is understood that Mr. C. M. D. Belton will remain as Engineer and Manager of the Company, thus continuing a family association with the concern which goes back to 1879, when his uncle, the late Mr. William Belton, was appointed to a similar position which he held for 40 years.

Gas-Works Effluents and Ammonia*

Reviewed by Dr. A. C. Monkhouse

One of the complaints which has been made of the detailed research reports presented to The Institution of Gas Engineers is the difficulty experienced by the busy gas engineer in finding the section in which he is interested and of gleaning an answer to his specific problem. The monograph under review remedies this defect and provides an excellent summary.

The book is a monument to the work of the Liquor Effluents and Ammonia Committee of The Institution of Gas Engineers, a Committee which comprises not only representatives from the Industry but also members dealing with effluents in an administrative capacity. It is through its work that the difficulties which faced the Industry some 15 years ago have been largely overcome and fundamental data obtained.

The monograph contains 152 pages, is tastefully bound in blue cloth, and is published at the reasonable price of 5s. The Institution is to be congratulated on its enterprise and it might with advantage consider the possibility of publishing other summaries, of value both to Industry and to its students.

Dr. Key has virtually written a new book using the reports and recent work as a basis. In some sections where he considers knowledge in the Industry scanty, he has presented a summary, as in Section IV., dealing with the composition and treatment of town sewage. The result is a unified picture. Certain overlapping is unavoidable in a work of this kind, but by cross-reference and a very complete bibliography this has been reduced to a minimum.

The first half of the book deals with the composition of gas-works ammoniacal liquor and effluents. Types of sewage purification plant in use and the effect of waste liquors on their operation are described. The influence of the various constituents of the liquors on sewage purification is indicated and the most desirable composition assessed. Criticism may be made that too great a portion has been devoted to these sections, but it should be realized that on this valuable work has been built that goodwill which exists between local authorities and gas undertakings.

Section V. epitomizes the legal position and gives practical advice on the satisfactory disposal of waste liquor into sewers. Methods are described whereby gas-works effluent can be improved either by modifications in works practice or by subsequent treatment—*e.g.*, phenol recovery. The Author reviews the methods of manufacture of sulphate of ammonia, giving comparable costs of manufacture by the various systems. The many ingenious schemes, none of which has attained practical importance, to combine gas purification and ammonia recovery are described. The section dealing with ammonium carbonate may prove of great value, should a demand for the product arise, and herein lie the fundamental data necessary. The final section, and a most important one, deals with the manufacture of concentrated liquor, the production of which gives to the smaller undertakings a possible means of making a small profit from ammonia recovery, the concentrated liquor being transferred to some central works, preferably with its own sulphuric acid plant. In an Appendix of 11 pages are collected methods of analysis of ammoniacal and spent liquors and also of sewage, which should prove invaluable to chemists.

It has been said that the findings and recommendations of the Committee have not met with the response from the Industry which was expected. It is hoped that this valuable and most readable summary by Dr. Key will arouse that interest which has been lacking.

The book can be thoroughly recommended to those interested in the disposal of ammoniacal liquors. Whatever the future of by-product ammonia may be, there is in this slim volume the basic material for any future work.

* Gas-Works Effluents and Ammonia, by A. Key, D.Sc., Ph.D. The Institution of Gas Engineers. Price 5s. net, cloth.

New Collin Coke Oven Installation

In the year 1934 the Lambton, Hetton, & Joicey Collieries, Ltd., had under serious consideration the replacement of their existing coke ovens, consisting of a battery of 35 Semet Solvay waste-heat ovens built in 1910 and a battery of 35 Simplex regenerative ovens built in 1918. These ovens were 32 ft. long between doors, 8 ft. in height, and of 20 in. mean width; they were stamp charged, the coal cake weighing approximately 8 tons. The coal used was not orginally considered to be a true coking coal but rather a gas coal, containing up to 33% of volatile; hence the adoption of stamp charging.

The existing accessory equipment was considered to be good enough for some years' working, and this factor influenced the decision to retain stamp charging and the existing oven sizes, which were considerably less than those of most of the modern ovens built during the last few years. A further point to be taken into consideration was the restricted site and the fact that the new ovens had to be erected with the least possible interruption to the output of gas and coke, particularly the former, as the company had a contract to supply gas to Sunderland and Houghton-le-Spring.

In order to ascertain whether the coal was suitable for top charging, it was tested in various ovens in this country and also in the Collin top-charged ovens built by Gas Chambers and Coke Ovens, Ltd., at Pont Brule, Brussels. The latter test successfully demonstrated the suitability of this oven for making a satisfactory coke, due no doubt to the Collin arrangement of heating alternately upwards and downwards in each individual heating flue.

It was finally decided to build a battery of modern ovens on the site of the existing waste-heat ovens, the new installation to be designed for eventual top charging, but at the start to be operated by means of the existing stamp-charging equipment. The colliery company placed the order with Gas Chambers and Coke Ovens, Ltd., the battery consisting of 30 Collin simple regenerative ovens, built in two sections so as to interrupt the output of coke and gas as little as possible. Half the waste-heat ovens were demolished—the remainder being kept in operation—and the site prepared for 15 new Collin ovens which were completed in October, 1935; in November of that year the remaining waste-heat ovens were removed, and a further 15 Collin ovens erected and started to work in July, 1936.

In December, 1936, it was decided to replace the Simplex regenerative ovens, and an order was placed for a further battery of 30 Collin simple regenerative ovens, to be built on a new site immediately adjoining the Simplex, and on the same centre line, to facilitate charging and pushing with the existing machinery. This second battery of 30 ovens was completed and started coke making last January, when the Simplex battery was shut down.

The two original plants, comprising 35 waste-heat and 35 simple regenerative ovens, were built of semi-silica, and had a combined throughput of about 400 tons of coal per day, with an average carbonizing time of 28 hr. The two new batteries comprising 60 Collin silica ovens carbonizing the same stamped charge have a throughput of over 500 tons of coal per day, with a carbonizing time of 22 hr.

It is expected that when top charging is adopted the throughput of the new ovens will be increased. Modifications and additions have been made to the original by-product plant, and when the increased throughput is realized other additions will be necessary.

This photograph was taken at the B.C.G.A meeting at Perth on Nov. 9. Among those in the group are : Lord Provost Nimmo (Perth), Mr. Adam (Town Clerk, Perth), Bailie Gowans (Gas Convener, Perth), Dr. Main (M.O.H., Perth), Councillor G. Catto (Aberdeen), Mr. John Wilson (Gas Engineer and Manager, Dundee), Mr. A. C. Rea (Gas Engineer and Manager, Perth), and Convener Loggie (Gas Department, Dundee).

Autumn Research Meeting

Nov. 1 & 2, 1938

Written Contributions and Replies to Discussions of the **Institution of Gas Engineers**

In this Fifth Institution Number of the "JOURNAL" we publish the written contributions to the discussions together with the Authors' replies as far as they are available at the time of going to press. The remaining replies will be published subsequently.

42nd Report of the Joint Research Committee of the Institution and Leeds University

Combustion Characteristics of Town Gas. Part III.—Properties and Method of Use of the Aeration Test Burner (Model A)

Research Chemist: James W. Wood, M.Sc.Tech., A.I.C. *Research Assistant*: A. H. Eastwood, Ph.D., A.I.C.

Communication No. 189

Mr. H. J. HODSMAN (Leeds University) wrote: When Mr. Wood presented his Report last year I pointed out that the method of admitting and controlling air supply to test burners was open to objection for the reason given in the present Report. Too much depended on the accuracy and permanence of a fine screw thread. Mr. Wood indicates that in improved designs this is being replaced by a slide valve control, actuated by a micrometer. There is at least another alternative, namely, the use of a rotating slide valve with an arc-shaped slot, such as is in use in our laboratory at Leeds. With the assistance of Mr. G. A. Woodwark I have examined the possibility of using such an air-shutter. Though it appeared to be mechanically satisfactory its adoption would obviously depend on the precision with which it could be reproduced. From enquiries which I have made it appears possible that the vital parts could be moulded in bakelite with sufficient precision. If this is true, then the question of reproducibility would be solved automatically. Cost should be reduced and change of calibration due to wear should be negligible.

Mr. J. W. WOOD, in reply, wrote: The point made by Professor Newitt and Mr. Forshaw is conceded—namely, that the type of orifice used in the Aeration Test Burner may not result in the highest possible degree of primary aeration. On the other hand, in the present instance reproducibility and ease of examination were regarded as more important than a high air/gas ratio. It is possible, of course, that alteration in the type of injector might produce a steadier inner cone, thereby improving the accuracy of reading, and the matter will therefore receive further attention. In view of the fact that the time of passage of the air/gas mixture through the burner stem is of the order of only 0·5 sec. it is felt that it would be unwise to design the injector so as to eliminate turbulence completely and rely upon diffusion for producing a uniform mixture at the burner head. In any case the stem is sufficiently long largely to damp out such eddies as may be formed at the injector.

Trial alone will demonstrate whether the type of air-shutter described by Mr. Hodsman is better than the micrometer-operated slide-valve now under examination as an improvement upon the original pattern. The error produced by deviation of the burner stem from the vertical is negligible if the instrument case is placed upon a reasonably level table. A filter on the gas stream has already been added to a number of burners where gum troubles are anticipated.

Several speakers raise the question of the fixation and maintenance of the scale of the Aeration Test Burner, which at the moment agrees very roughly with those of Ott and of Czakó and Schaack. It has not yet been determined upon whom should devolve the responsibility of fixing the scale of the standard burner, but it may be taken that the relative merits of standard gas mixtures and of aeration measurements for purposes of calibration have already received consideration by those concerned, and will receive further attention in the near future.

In my opinion it is not desirable for individual users to attempt re-calibration of their Aeration Test Burners. By the use of cylinders of compressed gas it is possible, however, for them to ascertain when their burners have departed from initial calibration by more than an agreed amount, whereupon they should be returned to the makers for re-adjustment and comparison with a reliable sub-standard instrument.

It is felt that the Aeration Test Burner has now been brought to a reasonable degree of consistency in reading, and that before spending further time upon the improvement of the instrument we may proceed to the next phase of our investigations—namely, to ascertain to what extent the purely empirical readings of the burner quantitatively indicate the behaviour of gases in ordinary gas appliances, both domestic and industrial, and experimental work in this direction is already in hand.

1st Report of the Gas Works Safety Rules Committee

Communication No. 191

Mr. G. M. GILL (London) wrote: For some years I have been brought closely in contact with the subject of the safety of gasholders and have indeed been responsible for no less than 740 reports on gasholders for insurance purposes during the past twelve months. I have made no complete summary of the defects affecting safety, but seeing that I am constantly dealing with the matter, I have these more or less clearly in mind.

The Committee limits itself in its report to the two questions of "Corrosion of Gasholder Sheeting" and "Anti-Freezers Causing Siphoning of Sealing Water from Cups of Water-Sealed Gasholders." I have no criticism to make of the Committee's recommendations so far as these two matters are concerned, but I would like to enlarge somewhat on the first-named matter and also to refer to various other factors affecting safety.

Experience shows that the cups of gasholders are liable to cause a good deal of trouble. Inspections have disclosed that quite a number of cups have developed serious leaks which at some time have been stopped with wooden plugs. I need not say that this is a very bad practice and can readily result in a serious mishap.

The Committee refers to corrosion at the wind and water lines. I have invariably advised that all wind and water lines should be thoroughly cleaned and protected by the application of non-drying paint. A large number of cups contain several inches of soft deposit which is the likely cause of undue corrosion at the bottom of cups. Recently I have had samples of water taken from the cups and compared with water in the holder tank and have found that the water in the cups is in some cases more likely to cause damage to steelwork than the water in the tank. A frequent cause of complaint is the presence of stones in cups. In some districts it appears to be a popular recreation to throw stones at the gasholder.

A common defect is the condition of the bolts at the connexion of the horizontal girders with the columns. These are frequently broken or in a bad state of corrosion.

The condition of axles and rollers of the carriages is often a matter of criticism in gasholder reports. It is not unusual for surveyors to find these very badly worn or seized-up. Regular lubrication is, of course, the remedy. In numerous cases adjustments are necessary, and want of such adjustments is often the cause of holders working out of level.

Foreign material of various kinds is not infrequently found to be lodging on rest blocks. I have on many occasions recommended the use of a special tool for the purpose of examining rest blocks. The occasional landing of holders under the observation of a competent man is very advisable.

At one time it was thought by some gas engineers that metal fatigue was going to play an important part in shortening the life of gasholders, but subsequent experience, aided by the examination of a very large number of specimens of the sheeting of old gasholders, suggest that the life of gasholders, except in isolated cases, is not likely to be materially shortened by this cause.

The weighting of gasholders is becoming increasingly popular, but it is introducing a real danger in the case of holders landing, especially those which are weakly constructed. Weighting in all cases requires careful consideration. Alarm bells to warn the man in charge whenever a holder is going to blow or land are well justified, especially in the case of holders which are weighted on the crown or are being lowered by boosting plant.

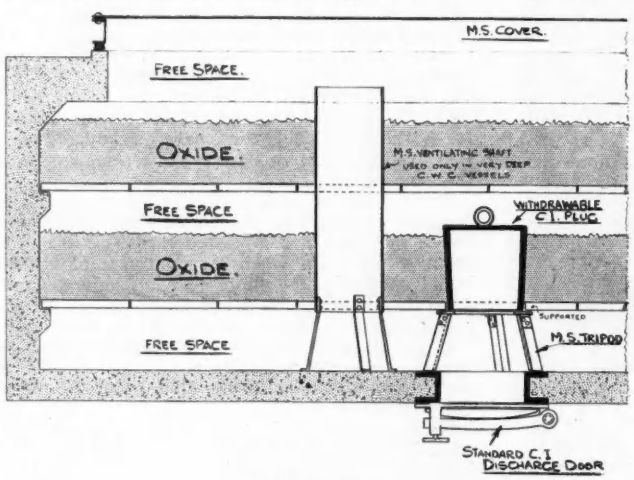
Last but not least, I would refer to the absence of hand-railing and ladders on many gasholders. These are, except in a minority of cases, very important to enable the works staff and visiting inspectors to make a proper examination of a gasholder. Ladders are not always essential in the case of small holders, but hand-railing in the great majority of cases is quite essential. Anyone who has tried to walk on the crown of a gasholder during a wind and after it has been raining will realize, if he has not before, that it is a most dangerous proceeding unless the holder is protected by hand-railing. Even at other times it is distinctly unpleasant, and I think that it is our duty as gas managers to make good this initial deficiency.

Corrosion of Cups.

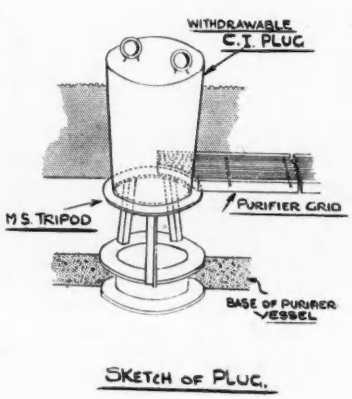
Mr. S. HAY (Gas Light and Coke Company) wrote: Although the 1st Report of the Gas Works Safety Rules Committee is not very voluminous and may be considered by some to be a little vague, it must have entailed a fair amount of thought, and the Committee is to be congratulated on having evolved a set of rules which should meet the varying circumstances it has set out to provide for.

In the reference to corrosion of gasholder cups it is suggested that this may be obviated by keeping the cups properly filled with clean water. I have seen examples of corrosion of sheeting and rivet heads which may have been accelerated by slurry in the cups, but I should like to ask what is meant by clean water, as in a holder cupping and uncupping several times per day the cups are filled from the tank. Where a holder is giving off H_2S it is surely not intended to add "fresh" water which may tend to increase the sulphate content and thus aggravate the H_2S trouble.

I would emphasize the need for the regular operation of gas works valves. At Beckton we have had for years a regu-



General Section.



SKETCH OF PLUG.

Withdrawable Plugs for Purifier Boxes.

lar system of lubricating and operating valves, and a register is kept of the dates when this is done.

We have had printed rules for the emptying and charging of purifier vessels for several years, which in the main agree with those of the Committee. The assistant engineer in charge of purification decides which vessel is to be emptied and it is put in the last position for 24 hr. before being shut out.

The valveman commences to shut out about 6.30 a.m.; all valves are logged and the vessel tested. About 7.30 a.m. the purification foreman tests again and orders the covers to be lifted. It may be of interest to mention that in overhead vessels we have special plugs in the bottom tier of oxide, and the first operation is to break down through the top tier of oxide and take out these plugs. These ventilate the bottom of the vessel. The men engaged in the vessel stand aside as soon as the plugs are taken out and the bottom discharge doors are then opened from below.

The following points which occur to me may be noted as safety measures:

(1) The picks and crowbars used by the men in breaking up the oxide are made of Immadium.
(2) Where air is admitted at the inlet to purifiers under pressure it is advisable to insert suitable non-return valves in the air lines.
(3) On summer load we have plant out of action and for safety we keep vessels under gas pressure, governed through a small connexion.
(4) When purifiers are built at ground level on piled foundations care should be taken that there is no cavity under the vessels, as this can become a source of danger in the event of gas leakage.

Wind Tunnel Tests.

Mr. J. W. Scott (Manchester) wrote: The idea of testing a model gasholder in a wind tunnel is an excellent one as applied to gasholder research, for I understand it has been practised for a considerable time, for ascertaining stresses on aeroplanes, and it would be useful if this method could be applied to other structures that are called upon to resist strong wind pressures.

I am inclined to the opinion that the proposed test, when carried out, will shake some of our theories relating to gasholders, and in any case it will prove whether it is necessary to provide for 40 lb. per sq.ft. wind pressure on the windward side, ignoring the effects of suction, as a requisite safeguard to a circular structure such as a gasholder, which presents to the wind a large surface area.

I have found that some engineers consider that the suction on the leeward side also has a great overturning effect in addition to force existing on the windward side, so that the test will be invaluable.

In the early days of spirals, engineers were not as particular as they are to-day; indeed, the gasholder storage was seldom inspected and treated, one might say, as a reliable servant.

There are gasholders operating to-day, having carriages and axles which, if our reputed storm records are reliable, should have failed years ago, while calculation suggests that a wind pressure of about 25 lb. per sq.ft. is about all they could safely withstand.

From the early days, however, it was found that the spirally-guided gasholder resisted wind pressures much better than the guide-framed type, and it was repeatedly proved, where both gasholders were in use, and from pressure gauges fitted, that the oscillation of the spiral type was negligible as compared with the movement on the guide-framed type.

As in the case of the waterless gasholder, the guide carriages on a spiral holder are all exposed for examination at any time, and are therefore available for lubrication, if carried out.

When the spiral type was introduced, manufacturers appeared anxious not to encroach upon the cup space, so that a shallow guide rail was adopted. In modern gasholders this rail has been considerably strengthened and made deeper, while the carriage rollers have been designed so that the load as applied to the rollers is transmitted to the carriage, with less stress on the axles due to bending moment.

The following example shows that the excellent regulations regarding the examination of gasholders, introduced by the Institution under the able leadership of Mr. Thomas Hardie, are fully justified:

I recently had to deal with the reconditioning of a 1½ mill. gasholder in a steel tank erected at the ground level. There is a balcony around the tank, with hand-rails, and a ladder to the ground. There are no ladders on the gasholder lifts, no hand-rails, and owing to the low pressure thrown by the inner lift, it is never uncupped other than for the periodical painting. The rollers and carriages are of cast iron, the axles of small diameter, and the lower ends of some of the spiral rails are wasted away, and although it is erected in a very exposed position, it has never been out of service for 35 years, and from this fact alone it will be realized why I am interested in the proposed test.

2nd Report of the Pipes Committee

Communication No. 192

Mr. W. G. Head (London) wrote: The following observations may be of interest to members of the Institution as they are based on my experiences of air raids during the Great War when among other duties I was in charge of the Mains Department of the South Metropolitan Gas Company.

Great credit is due to the inventor of the mains plunger with cone guide, described in the report, and where there is a clean blow-out clear of obstacles, as might occur in outlying places, it might be useful.

In an air raid the proportion of damage done by direct hits on gas mains will be small compared with damage done by concussion from bombs exploding some distance away. In big towns where the subsoil of the streets is packed tight with mains, pipes and cables there will be such a tangled mass of cable and débris, etc., that access to the open gas mains will be most difficult and slow. If a steel main is blown out it would be impossible to insert the cone plunger into the jagged and distorted ends even if they were clear of obstacles. In such cases a water main would probably also have suffered and the gas main might then be automatically sealed by flooding. In any event it would be necessary to excavate down on to the main at safe distances away and bag or bladder in the usual manner.

With mains split by concussion and which are still covered by soil the escaping gas will spread over a wide area and ignition is more likely to occur. In such cases bagging back will have to be carried out at considerable distances from the flames. I remember a case where central connexions were so damaged that bags were inserted in nine places before the flames were extinguished and the gas shut off. However bad the blow-out it is desirable, especially with big mains, to maintain gas pressure therein and save lighting-back with possible blowing up of long lengths of street.

When damage occurs and gas is escaping, bagging-off must be done as soon as possible and with big mains of, say, over 12 in. diameter it is quicker to open down and cut bag holes with a hammer and chisel than to wait to excavate the whole main in order to fix drilling tackle. In crowded streets there is often insufficient space to fix the drilling tackle as other pipes, etc., are in the way. The old-fashioned bag-hole plate with tee bolt can be used temporarily until such time as it can be replaced by a suitable screw plug.

Considerable delays may occur by incorrect reports as to the position of the damage. Several people may telephone the Gas Undertaking and describe the location differently so it is quite possible for the staff to arrive on the spot prepared

to deal with a larger main where only a small one has been damaged and *vice-versa*. I remember receiving over twenty calls one night when damage to only two or three mains had occurred.

I am pleased to state that I have had no experience with gas mains damaged in underground culverts. There are culverts in South London provided by the Local Authorities in which pipes, cables, etc., are laid. The South Metropolitan Gas Company refused to use these culverts as it considered the gas mains were safer buried in the ground. The question of having gas mains in culverts from the A.R.P. point of view should be most carefully considered.

It is to be supposed that most gas undertakings keep detailed plans and records of mains laid. These plans and records should be photographed or copied and the copies kept away from the originals. District foremen should be provided with plans of their respective areas and be trained to report damage correctly, leaving nothing to the imagination of the headquarters staff.

In addition to the usual pipe spaces, specials, tools, clay, etc., which should be kept in stock, strong pumps should be provided for clearing flooded gas mains. I know this from experience! I would also suggest that suitable men be given opportunities for practising the cutting of bag holes in large gas mains, taking care that the cut-out discs be not allowed to fall into the pipes. Practice in bagging is also useful.

Fusion Between Electric and Gas Services.

Mr. J. A. GOULD (South Suburban Gas Company) wrote: With regard to the question of fusion between electric and gas services, I had a good deal of trouble some time ago because electric service cables were laid through the front walls of buildings at the same point as the gas services. It was not unusual for the reinstated holes in the walls made by the Gas Company to be re-opened by the employees of electricity undertakings for the purpose of laying their electric cables into the buildings. I would suggest that it would be helpful to us if the Committee enlarged upon its statement that reasonable precautions should be taken to prevent the coming into contact of gas and electric services. As a general rule there is no reason why these services should not enter buildings some distance apart, say 4 or 5 in. I think the use of the word "close" as qualifying the contact of the two services is undesirable and might with advantage have been omitted from the Report. Any measures taken should have as their object the avoidance of any contact between such services.

The work of the Committee in connexion with the Institution's Specifications for Wrought Iron is very useful, but I would suggest that the new Specification for Wrought Iron Bars might, with advantage, have been incorporated in the revised Specification for Wrought Iron Gas, Water, and Steam Qualities Tubes and Fittings. Clause 1 of the 1930 edition remains unaltered in the revised Specification, and the remaining requirements in the revision appear to be those of British Standard Specification No. 788—1938, Wrought Iron Tubes and Tubulars, Gas (Light), Water (Medium) and Steam (Heavy) Qualities. This last Specification, however, does not refer to "fittings" and states that tubulars shall be made from tubes produced in accordance with Part 2 of the Specification, which lays it down that the tubes must be butt- or lap-welded according to their size, and, therefore, I presume must be fabricated from strip. I may not have a clear understanding of the position but a point such as this should be made clear.

To return for one moment to the Specification for Wrought Iron Bars, I should like to know if in the cold nicked bend test it must be assumed that the "bending back at the nick" has to be the same bending test as is described for the cold bend test.

I would like to express my particular appreciation of that part of the Committee's Report dealing with a method of extinguishing fires in gas mains. The Committee deserves our best thanks for its work in this connexion. The plungers illustrated and described in the Report are an elaboration of the ordinary mains plunger and are very effective in use, as I know from personal experience. I imagine that if they are to be used effectively to extinguish flames from a 12 in. diameter main discharging gas under ordinary working conditions of pressure and volume, the man responsible for placing the plunger in the open end of the main would require an asbestos suit to enable him to carry out his work.

Pipe Socket Design.

In the foreword of the Revised British Standard Specification for Cast Iron Pipes issued recently, reference is made to the alteration in the design of the pipe socket—a major alteration. I think it is rather unfortunate that special reference to this important alteration should not have been made in the covering letter sent with the draft of the Specification which was circulated by the Institution in December, 1936. I mention this point because although I examined the diagrammatic sketch of the socket, I did not have full-size sections of the new sockets drawn out. When I read the foreword to the new Specification and realized that alterations had been made to the sockets, I had sections of the sockets drawn and was very surprised to find that the moulding at the back of the socket band was relatively flat compared with the previous design. The new design, in fact, is very similar to that of continental pipe sockets.

Many of us have, no doubt, been faced with the problem of how best to convey gas at high pressure through mains jointed with run lead which were originally laid as low-pressure mains. I have found as a result of very careful investigation that in practice the joints on such mains can be made gas tight only by fitting them with leak clamps. I have experienced difficulty with a 450 mm. (approximately 18 in.) diameter pipeline. The leak clamps were specially designed for these pipes, but owing to the slow curve at the back of the socket face the socket ring of the leak clamp in some cases stretched over the moulding. At the Annual Meeting of the Institution held in 1937, when discussing Mr. Escreet's Paper on Distribution in Suburban Areas, I referred to the use of leak clamps and mentioned that up to 1935 these could be obtained only from America, and the position to-day is that such clamps, adjustable to fit snugly around any socket and thus allow for manufacturing tolerances, can still be obtained only from America. I understand, however, that the English Company which manufactures leak clamps is working on this improvement at the present time. It would seem that the fixing of such clamps and also testing caps, etc., was not considered when the alteration in design of the socket was under consideration. I would suggest most earnestly that the whole question of leak clamps and flexible joints should receive the consideration of the Committee, since it is one which, in my opinion, is of great importance in distribution work of to-day.

Protection from Rust.

Now that mild steel tubing is used extensively in the Gas Industry for carcass work, it would be of help if the Pipes Committee would give consideration to the best method of affording to such material internal protection from rust. I have been concerned at the necessity for seeing that this tubing is free from corrosion, at any rate at the time it is installed. Unless preventive measures are taken, the tubing commences to rust as soon as it leaves the mill, and this deterioration is accelerated considerably by its early contact with water during the hydraulic test. In my opinion, the tubing should be given a protective coating as early as possible and certainly before the hydraulic test. I have been negotiating since the early part of this year with the largest suppliers of tubes in the country for this to be done, and I might add that my views have their agreement since they realize that steel tubes, even when lying about in their works, are subjected to oxidation. The methods I am considering provide for the air testing of the tube in a bath of oil, after cutting and screwing and before the hydraulic test. The ends of the tube would be closed before its submersion in the oil bath, and after the air test had been applied the ends would be opened and the tube flooded with oil. The surplus oil would be removed and the tube dried in a stove.

I would conclude my remarks by referring to those I made last year, when I stated that in my opinion the Committee could with advantage deal with many other matters, and that its name might be more appropriate if it were "Distribution Committee." There are, as I said last year, many matters where the drawing up of a standard practice would be ad-

vantageous to all Companies. Of such matters, to mention but a few, the agreeing of standard positions for gas mains in relation to the plant of other undertakers, the laying down of methods for supporting undermined mains, the consideration of the effects on gas mains of the use of mechanical excavators, and the drawing up of standards of test for tightness of mains, come readily to mind.

Mr. Escreet's Reply.

Mr. H. J. ESCREET, in reply, wrote: I have read with much interest Mr. Gould's written contribution to the discussion and am obliged to him for his helpful criticism on several of the matters dealt with in the Report.

I agree that the wording "close contact" referring to the position of electric cables and gas pipes entering premises is unfortunate. It is, of course, desirable that the pipe and cable should be separated by several inches whenever possible.

The question of the Specification for Wrought Iron Bars was also raised by Mr. Richbell, and as stated in my verbal reply to the discussion, a modification of the title is necessary. This matter will be dealt with by the Committee and the correction made before the Specifications are published.

With reference to the use of the plunger when dealing with flames from a 12 in. main, I agree that unless the pressure could be reduced it would probably be advisable to provide an asbestos suit for the man using the plunger.

Mr. Gould has referred to the change in design of the pipe socket in the revised British Standard Specification for Cast Iron Pipes. The question of design of the socket was dealt with a number of years ago, and although I was not at that time a member of the Committee of the British Standards Institution, I believe that very careful tests of the strength were made before the modified design was accepted, and that that design was proved to be stronger than the old British standard. I cannot think that there can be any very serious difficulty in so designing the leak clamp that it can be used with the new type of socket, but in any case it would not, I feel, be reasonable to ask the British Standards Institution to base the design for the socket upon the use of leak clamps; surely if it were found that these clamps were really effective and had long life, the natural development would be to adopt rubber joints in the first place and thereby dispense with both leak clamps and the British Standard open socket!

I note that Mr. Gould would like the Committee to consider this question of leak clamps and flexible joints, and I will bring this matter before it.

As regards the internal rusting of steel tubing, this is no doubt of importance when wet gas is distributed, as was stated by Mr. Dean Chandler in discussing the relative merits of wrought iron and steel pipes. As only dry gas is distributed by the Gas Light and Coke Company, the difficulty referred to has not been experienced in its area, and I have no knowledge of a suitable internal coating. I think the suggestion made by Mr. Gould for an internal oil coating would probably meet the position.

In his concluding remarks Mr. Gould suggests that the Pipes Committee, or, as he would prefer to call it, the Distribution Committee, might deal with the standardization of numerous matters which affect not only gas mains but the works of other undertakers which have plant in the public streets. These matters will, of course, be referred to the Committee, but my own view is that such questions can usually be settled more easily by dealing with the other engineers in each particular district, rather than by attempting to lay down a standard for the whole country.

I am grateful to Mr. Head for his very useful account of his experiences of air raids during the Great War. I am sure that his contribution to the discussion will be read with great interest by all those responsible for gas distribution systems, but I do not think that there are any matters which call for a reply.

43rd Report of the Joint Research Committee of the Institution and Leeds University

The Investigation of the Use of Oxygen and High Pressure in Gasification. Part III.—Synthesis of Gaseous Hydrocarbons at High Pressure

Research Chemist: F. J. Dent, B.Sc., Ph.D. *Research Assistants*: W. H. Blackburn, M.Sc., Ph.D.; H. C. Millett, B.Sc., Ph.D.

Communication No. 190

Dr. Dent's Reply.

Dr. F. J. DENT, in reply, wrote: I would like to express my gratitude for the encouraging reception of the Report, and for the valuable discussion which followed it. Much of the matter contributed was by way of suggestion, and this will receive most careful consideration in planning further work. At the moment the fields for investigation seem very wide indeed. So far, laboratory experiments have been pushed forward upon lines which appeared most likely to lead to a workable high-pressure process, suitable for the present or not far distant needs of the Gas Industry, with the idea of testing such a process in an experimental plant as soon as some confidence of technical success had been obtained. The tests would be made to decide on the best arrangement for the process, to assess it economically, and to find leads for further and more exhaustive laboratory work. I am pleased to hear that the various speakers consider that we are approaching the stage for such large-scale experiments, for I share that opinion.

Professor Townend draws attention to an aspect which requires more exhaustive laboratory work when the lines of the main gasification process have been fixed—viz., the production of liquid hydrocarbons. This aspect clearly merits the closest study. Under present conditions the proper combination of the production of gaseous and liquid fuels is likely to be of considerable importance in the economics of the process, and there is the national viewpoint of the desirability of developing motor fuel resources.

Professor Townend also mentions the influence of compressibility on the position of equilibrium in systems at high pressure. It should be pointed out that, in calculating the equilibrium-composition for the system carbon, hydrogen, and methane, such corrections have not been applied, it being assumed that at the relatively high temperatures the hydrogen and methane behaved as perfect gases. Actually, in Figure 16 the calculated curve for graphite should be rather lower on the diagram—*i.e.*, further removed from the experimental points.

Dr. King's interesting initial comments call for no reply. He continues with some observations on the important control of temperature during hydrogenation on the large scale. So far as can be seen at present, it seems that the heat evolved by hydrogenation reactions will result in a rise of temperature, but, as the temperature increases, change in the position of equilibrium will eventually restrict hydrogenation until the amount of heat liberated is just sufficient to raise the coal and hydrogen to reaction temperature. Thus, control of the temperature should be obtained through the operating pressure and the temperature of the ingoing hydrogen. If found

necessary, further control will be possible by adding steam to the hydrogen, moisture to the coal, etc.

The use of pulverized coal, on which Dr. King himself is working, appears to offer the greatest possibility of leading to a continuous process, and we are watching Dr. King's progress along this difficult line of research with the closest attention. When using coal of larger grade, the possibility and even the desirability of a continuous process, in the accepted sense of the term, is more a matter of question. Many of the processes normally regarded as continuous are discontinuous at one or more points—*e.g.*, at charging and discharging hoppers. When operating at high pressure, it may prove more convenient to use a batch process than to break frequently the joints on charging and discharging apparatus in order to obtain continuity in this gasification vessel.

Mr. Davis and Mr. Rhead are in favour of obtaining experience on the plant scale in the near future. One of the main questions to be decided on the larger scale is whether fuels can be satisfactorily hydrogenated without special steps being taken to prevent them caking. This question is not a critical one, but the direct use of a caking charge would add considerably to the flexibility of the process. No difficulties have been encountered in the laboratory 4 in. retort, but this gives little guide to behaviour on the larger scale, which must be investigated before the details of a process can be worked out.

Mr. Davis draws attention to the practical significance of a number of laboratory results. His remarks on the behaviour of sulphur and the properties of the coke residue are particularly interesting. The properties of the coke will probably be even better when hydrogenation is carried out on the large scale by heat entirely developed internally when exposure to high temperatures is expected to be less than in the laboratory apparatus.

In answer to Mr. Rhead's query regarding hydrogenation at low pressures, while these conditions are being explored in the laboratory, they will be best studied on the larger scale. The pressure finally used will be governed mainly by consideration for the development of heat to maintain reaction temperature and, in the laboratory retort, we are not independent of external heating for this purpose. I agree with Mr. Rhead that the use of catalysts will most likely influence the pressure necessary.

Professor Egerton's remarks on methane and other hydrocarbons have a most important significance, due to the fact that, whereas our investigation began as a search for methane, the present position is that it can be produced in such quantities as to be likely to become an embarrassment if other outlets are not developed for it. His own studies of the applications of methane should prove most valuable in this connexion.

I appreciate Professor Egerton's remarks on the cost of producing hydrogen, but it should be pointed out that, in a two-stage process, there is the possibility of the cost per therm of final gas being less than the cost per therm of hydrogen produced in the first stage. It depends upon the cost of the thermal output of the second stage of hydrogenation.

Interim Report of the Sub-Committee on Unaccounted-for Gas

Communication No. 194

Mr. W. TEMPLETON (Leeds) wrote: The primary concern of the Committee is to try to arrive at a formula which would afford a reasonably accurate determination of the difference between the actual volume of gas made and the total volume accounted for after it leaves the station meter. The general inference is that the difference is due to loss either by leakage in mains and services, or in meters by reason of faulty registration, leakage or temperature differences.

Mr. Lacey submits and reviews two questions, in the first of which I am mainly interested: "The question as to what are the limits of accuracy and the suitability of the existing methods of meter proving—especially at low rates of gas flow." He proceeds, "I will content myself by saying that our investigations show that the technique of proving meters is open to substantial improvement, both as regards accuracy and speed of operation."

I would first ask Mr. Lacey if the improvement in accuracy concerning the prover is a comparison directed towards the workshop prover or a local measuring standard, and, if the latter, what is the extent of the alleged greater accuracy?

No one is more conscious than myself of the concern which refrigerator and pilot loads may have occasioned, but providing a meter be sound internally, that is, to register in the smaller group of meters at from 0·5 to 1·0 cu.ft. per hr. and the valve timing being set to keep the variation between tests at capacity and, say, 100 rev. per hr. within 1 per cent., then the results at 2·5 or 3 cu.ft. per hr. must be all that could be expected. This factor of valve setting is far more important in the accuracy of registration than the actual *plus* or *minus* setting within limits. If the Gas Industry desires to tighten the conditions. therefore, it would be of greater practical value to require a meter to register within a ± difference of 1 per cent. between. say, capacity and one-quarter of that volume, than to require a reduction of the ± existing tolerance.

New modern meters in particular may "run in" up to 2 per cent. faster than the figure of verification, but in a meter with properly timed valves the characteristic of the registration curve would remain unaltered, and it is this consistency of registration at varying speeds which is of primary importance.

A large percentage of the new meters passing through Leeds Office are within *plus* or *minus* 1 per cent. at capacity and 100 revs. per hr. or thereabouts, with the latter generally ruling some ½ per cent. faster than the result at capacity. It depends upon the quality of components, skill in assembly, class of lay-out, etc., as to how long that accuracy will be maintained. Any gum or other deposit on the valve faces which the shearing of the valve fails to remove must inevitably be reflected in the registration, and the degree of slow registration is inevitably more pronounced at the slow rates.

Regarding the second point by Mr. Lacey concerning the proportion of the gas used at low rates, I am convinced that further investigation will serve to emphasize the fact that the larger proportion of the gas used is at rates considerably below the capacity of the various meters, and thus serve to refute the implications by Mr. Bingham that defects are caused or accelerated by overworking. It would be interesting to distinguish between the experience obtained from "High Capacity" and "Lights" or "Standard" meters in view of the radical difference between the respective capacities, and the normal domestic consumer demand.

Testing at Capacity.

Mr. Edwards refers to the fact that at Port Talbot, meters are tested *in situ* every five years. Apparently this test is confined to 2, 4, or 10 cu.ft. per hr. and therefore is only a partial test which is principally directed towards internal leakage. Meters passing this test may still be subject to gross errors at capacity or thereabouts. The unaccounted-for gas has in a certain period been reduced from 10·6 to 5 per cent. and from 12·9 to 6·1 per cent., but there is no evidence to illustrate the extent to which this testing has actually influenced those results. In the case of a batch of old meters which I was called upon to examine, the larger proportion unexpectedly proved to be excess fast. These meters had all been tested *in situ* with a burner test, some 12 per cent. being reported to be defective at 1 to 2 cu.ft. per hr. With two exceptions they all proved to have considerable error in registration at capacity. In some instances where the meter

proved to be not registering at 1 to 2 cu.ft. per hr. it still proved to be excess fast at half to full capacity.

I am interested to learn that new and repaired meters are tested for accuracy at 0·25 cu.ft. per hr., and should like to know how this test is carried out and the degree of accuracy required. It should be observed that such a test implies the occupation of the apparatus for a minimum of 8 hr. irrespective of time taken in setting up, etc. Mr. Bingham's defence of the meter appears to rest upon the degree of over-working rather than the more obvious too long working.

Just what have meter manufacturers done to illustrate to the gas engineer the state of the components in meters? It is a closed instrument when he receives it and bears the official seal, the hall mark of accuracy, but for how long? Surely here is a splendid opportunity for the Committee to evolve and recommend the adoption of a formula outlining the economic life of a meter in terms of throughput and years.

Where overloading does take place, no doubt Mr. Bingham would be on good ground in suggesting that slow registration would be the result. My own experience is that it would be a happy state to find meters working up to capacity.

I join issue with Mr. Bingham when he states that modern meters work faster. Undoubtedly, owing to reduced grid area they "run in" more quickly.

To what extent a better ordered system of metering would contribute in reducing the degree of unaccounted-for gas is highly problematical. The Institution some years ago approved the principle of re-verification, and was moved to do so by statistics which did not permit of argument, but still the old policy survives. What is the position in the instance of those undertakings where meter rentals are in force? One wonders just how many meters remain upon the district after their capital cost has been extinguished, and to what extent faulty meters of that class are put forward for repair instead of replacement, also to what extent the unproductive meter has ever been credited with being a money spinner instead of an unfortunate overhead.

29th Report of the Refractory Materials Joint Committee

Communication No. 193

Dr. G. E. Foxwell (London) wrote: My only object in entering this Discussion is to refer to the attack of alkalis on silica bricks, a subject in which I took a good deal of interest when I was more directly connected with the coke oven industry. Section 8 of this Report gives a practical example of the manner in which the work that has been done on salt attack can be turned to account to explain an observed instance of corrosion. It would not surprise me if the sequence of affairs had been in point of fact the reverse of this, and the occurrence described in the Report had actually given the Authors some guidance upon the course of their experimental work. I would direct attention to the wording of the Report: "the coal used contained an average of 0·66 per cent. of sodium chloride. . . . The high sodium chloride content of the coal had little deleterious effect on this side (the inside) of the retort wall, doubtless due to the relatively low temperature of working. As a result the bulk of the coke has retained a considerable proportion of the sodium chloride to be liberated when gasified in the producers. . . . Under more severe working conditions the alkali action may be looked for more on the coal side of the retort wall."

My own experiments and experience lead me to the conclusion that salt may have two separate major effects on acid refractories: (i) By fusion with salt for long periods the silica is transformed into sodium silicate, the "clay constituents" (by which I mean the aluminous portion which presumably had originally the composition of kaolin or felspar) into a compound containing about 28 per cent. of soda, and in general the brick behaves as if it were fluxed; (ii) A specific action occurring in the inside of coke oven walls, known to the older generation of coke oven technologists as "salt corrosion." These two effects should not be mistaken the one for the other. The occurrence described in the Report appears to me to be a clear instance of fluxing action, *plus* (in the lower portions of the retort) the expansive effect discovered by Mr. Green and his colleagues. Salt fumes generated in the producer might be expected to have this effect, especially if assisted by the fluxing action of the dust. A somewhat similar effect was described by Professor J. W. Cobb in an early Paper to the Coke Oven Managers' Association, which will be found in the Gas World (Coking Section), April, 1916.

I hardly find myself in agreement with Mr. Green when he states that the lack of action in the inner surface of the retort was due to the conditions not being sufficiently drastic. This may be the explanation of the absence of slagging action such as was seen in the flues, because the temperature would be a good deal hotter, though whether the concentration of salt in the gases in the flues would be higher than in the retort there is no means of knowing. Mr. Green, I feel, should have given us some indication of the volatile salt content of the producer fuel. Certainly the much higher temperature in the flues would assist slagging actions, among which I class the direct action of salt on silica to form sodium silicate. In the interior of the retort or oven, however, I should expect to find genuine salt corrosion of the second class as the term is understood in the coking industry, if any action occurred. So far as my knowledge goes, however, the coking industry has never experienced salt corrosion in an oven constructed of lime-bound silica. This type of attack took place in ovens constructed of aluminous acid bricks. Within the limits of which I have had experience, namely, 55 to 95 per cent. silica, the rate of true salt corrosion was inversely proportional to the silica content of the wall bricks. A brick containing 90 to 91 per cent. of silica was not immune, when clay-bound.

The temperature in the coke oven flues of the older ovens built of highly aluminous silica was of the order of 1,100° to 1,200° C., and the coke would be heated to a maximum of some 900° to 950° C., this being the maximum temperature of the inner surface of the wall at discharge. A strong action took place at this temperature which caused re-building of the oven walls, sometimes after less than a year's working. Later, with the coming of semi-silica bricks, the flue temperature was raised to 1,250° C., and even up to 1,280° C., with a maximum internal temperature of around 1,000° C.; these bricks, too, were rapidly attacked, though less rapidly than those of higher alumina content, in spite of the higher temperatures. Then lime-bound silica bricks were introduced, the flue temperatures started at 1,250° C. and were ultimately pushed up to 1,350° C., with a maximum inner wall temperature of 1,050° to 1,100° C. I have measured these latter figures myself and the significant point is that in spite of the still higher temperatures salt corrosion ceased completely. Mr. Green's own figures show that the inner surface of lime-bound silica bricks used in a gas retort with a highly salty coal show no evidence whatever of any increase in alkali content. I have made similar analyses in the past and can confirm these figures.

It seems quite evident, therefore, that there are two types of salt corrosion, depending either on the composition of the brick or on the temperature. There are many questions that might be propounded as having a bearing on the subject. I suggest some of them to the Authors of this Report. What is the concentration of salt at the interior oven face? What is the course of the interaction of silica and sodium chloride? Does this action not take place below 1,100° C.? Why is there an interaction under practical conditions between a clay-bound brick and salt even at temperatures below 900° C., and yet no action between a lime-bound brick and salt at 1,100° C.? Is this due to the chemistry of the process, or to

factors connected with the practical operation of the carbonizing plant?

Mr. Green's Reply.

Mr. A. T. GREEN, in reply, wrote: We wish to thank Mr. Rhead for his very kind appreciation of our work. It is particularly gratifying to learn that it has been of service to him and that he has found confirmation of the expansile action of alkali vapours in some experiments of his own. We should like to acknowledge the encouragement and helpful criticism we have received from Mr. Rhead from time to time at meetings of the Refractory Materials Joint Committee of the Institution. With regard to the question raised, the available evidence would seem to suggest that alkali compounds of the felspar type are perhaps the most stable in contact with clay and silica refractories.

We are fully appreciative of the good work carried out by the Fuel Department at Leeds University and it is very interesting to hear the comments on our Report of a research worker concerned with problems similar to those entrusted to us for investigation. The usefulness of X-ray methods in identifying the products of reaction in ceramic processes is becoming increasingly evident and it is our intention to supplement the evidence obtained by microscopic examination by means of the X-ray technique in the near future. It should prove a very useful tool, not only in the investigation of slag action, but in connexion with many other problems in the manufacture and application of refractories. The precise significance of the zone of penetration in the action of slags on refractories is difficult of definition, but one would certainly expect materials so affected to be more susceptible to structural spalling. The work on the effect of hydrocarbons on refractory materials is continuing and we are endeavouring to ascertain more precisely the part played by the iron spots. It is hoped also to extend the work on the determination of apparent porosity by including measurements on materials of very high porosity.

It is very interesting to have Dr. Foxwell's contribution to the Discussion and to note that he can confirm from his own work certain of our observations made on the subject of the attack of alkalies on silica retort bricks dealt with in Section (8) of the Report. We should also be prepared to agree with Dr. Foxwell that there are two types of salt corrosion depending (i) on the composition of the brick, and (ii) on the temperature. At high temperatures (say, above 1,200° C.) it is probable that salt action with either clay or silica refractories tends towards the type of attack described by Dr. Foxwell as a fluxing action. At lower temperatures (around 900° to 1,000° C.) the type described as "salt corrosion" may be expected, in which it is probable that the expansion resulting from salt action plays an important part. In differentiating between the susceptibility of silica and clay refractories to this type of action the following points may be mentioned: (*a*) The greater rate of chemical reaction at the same temperature between salt and fireclay products as compared with salt and silica products; (*b*) The greater probability (roughly in proportion to the alumina content) of liquid products resulting from the reaction of sodium chloride with silica materials as compared with fireclay products at temperatures from, say, 900° to 1,200° C. These conceptions are being used as a guide to our present work on the subject, but we should prefer to await the results of further experiment before making more definite assertions.

The Production of Free-Burning Coke in Continuous Vertical Retorts

Communication No. 199

by

JAMES JAMIESON, M.Inst.Gas E.,

Engineer and Manager, City of Edinburgh Gas Department,

and

J. G. KING, B.Sc., Ph.D., F.I.C.,

Chief Chemist, Fuel Research Station, Department of Scientific and Industrial Research

Mr. G. DIXON (Nottingham) wrote: The provision of a solid smokeless fuel for domestic purposes of superior quality to the present average type of coke would be a further contribution by the Gas Industry in the general efforts towards smoke abatement. Its production and the extent to which it may be used are, however, dependent largely upon local circumstances. The coal fire still has many adherents in spite of its obvious faults, and to attempt to convert its supporters to the use of smokeless fuel, which in many districts may be far more costly to the consumer than the coal obtainable, may be found a very difficult task.

To have any appreciable effect upon the smoke nuisance, considerable quantities of smokeless fuel would have to be produced and consumed. The production of such fuel in any quantity may provide the gas engineer with many problems in its manufacture and entail provision of extra plant and labour which would increase the cost of such fuel in greater proportion to normal practice than that suggested by Mr. Jamieson.

Separate coke screening plants would be necessary for high- and low-temperature coke. Benzole washing plant may be necessary where this is not already installed. Low-temperature gas may give rise to sooting troubles in certain types of luminous burners, due to the production of unstable hydrocarbons in the carbonization process, and this may compel benzole recovery.

The tests at Edinburgh were made in downwardly-heated retorts. Retort flue temperatures may have to be very different in upwardly-heated retorts where the maximum temperature is at the lower level. It would be of interest to know what difference would be necessary in the temperatures on these two types of settings.

If part of a retort bench is producing low-temperature coke and high calorific value gas, does Mr. Jamieson suggest that the high calorific value of the gas should be controlled by increased steaming in the high-temperature retorts? This will add complications to the carbonizing process and possibly increased maintenance costs to the high-temperature retorts.

What factor controlled the percentage of steam used during the carbonization tests at Edinburgh? The figures given in Table 4 indicate that steaming of the charges was almost as high as in normal gas making. Did the steam in any way control the calorific value of the gas? Is there any indication that the retort steam influenced the structure or behaviour of the low-temperature coke?

Economics of the Process.

Mr. JAMES MITCHELL (Leicester) wrote: It gives me very great pleasure to congratulate the Authors of the Paper, Mr. James Jamieson and Dr. J. G. King, on an excellent Paper.

This Paper should remind us all that in the headlong flight towards the higher and higher makes per ton that characterize these vertical retort days, it may be well to pause and consider whether in our graspings after the gas therms we have not sacrificed something just as valuable.

I am very interested to find that in the conclusion on p. 30 the Leicestershire Coal-field is included as having available suitable coals for the production of this free-burning coke, and I shall be pleased to obtain further information regarding the particular collieries involved.

At Leicester we have, from time to time, considered the introduction of benzole recovery plant, but apart from constructional complications on the works we have always found that the water gas therm we obtain from the heavy steaming

in vertical retorts is a cheaper way of diluting the high calorific value of gas to the declared value of 450 B.Th.U. than is the benzole recovery method. It may be necessary for us to reconsider the whole question of gas production if it is found there are available coals on our doorstep, always supposing that we should be allowed by the Central Coal Selling Organizations to use them.

Whilst, as I have indicated, the experiment is most interesting, the criterion of its practicability will be found entirely in the economics of the whole process and mainly upon the price which the smokeless fuel will command in the open market. I doubt very much that such fuel will command a figure high enough to meet the extra cost for the larger size coal, and for the loss in thermal yield per ton. However, as local conditions will alter the circumstances I do feel that we should each give due consideration to this experiment.

Influence of Volatile Matter.

Mr. G. C. PEARSON (Birmingham) wrote: We have, in Birmingham, been faced with difficulties in regard to the disposal of coke that actuated the research described. Our normal coke production for sale is about 450,000 tons per annum and consists of approximately:

66 per cent. over 1¼ in.
20 per cent. between 1¼ in. and ⅞ in.
14 per cent. below ⅞ in.

Coke export constitutes up to 16 per cent. of our total sales, a lower percentage than that obtaining at Edinburgh, probably explained by our geographical position.

The substantial influence of fluctuations of coke sales upon our balance sheet has been fully realized and has influenced our decisions in the choice of carbonizing plants. Furthermore, we have introduced modern screening and dry cleaning plants, automatic weighing devices, and allocate to certain plants coals which are known to produce reactive cokes. These measures have met with success in the past but owing to the highly competitive state of the coke market our efforts now require intensifying. I have therefore read with the greatest interest the account of the experiments at Edinburgh.

The influence of the volatile matter left in coke is clearly shown by the combustibility curves and I have been very greatly impressed by the fact that the heat required for ignition of the normal Edinburgh coke has been reduced from 3,900 B.Th.U. per lb. to an average of approximately 1,550 B.Th.U. per lb. by the comparatively small increase in volatile matter and the choice of coals.

I have studied the balance sheet given in Section V and the conclusions. From the figures given it appears that there is a possible market in Edinburgh for a high-class smokeless fuel. In Birmingham, however, the coke sold is most carefully graded and has an attractive and bright appearance. I am of the opinion that were we to leave some 16 gaseous therms in the coke we should find great difficulty in obtaining customers willing to pay more than the price now charged.

Hot Patching of Retorts by Blow-Pipe Spray Welding

Communication No. 198

by

T. F. E. RHEAD, M.Sc., F.I.C., M.Inst.Gas E., M.I.Chem.E.,

S. K. HAWTHORN, M.Inst.Gas E.,

and

V. H. DEACON, B.Sc.,

City of Birmingham Gas Department

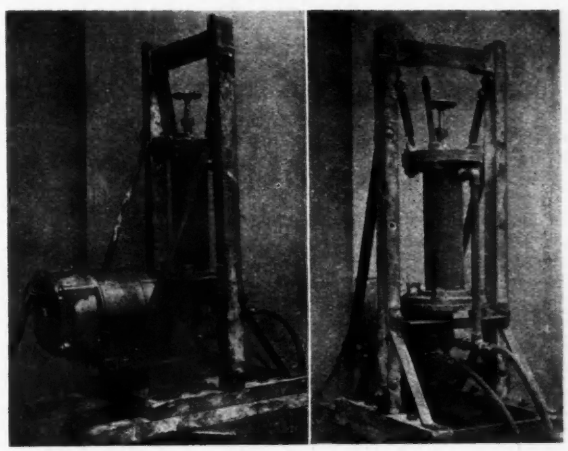
Mr. E. HARDIKER (Smethwick), wrote: By the courtesy of Mr. A. W. Smith, General Manager and Secretary of the City of Birmingham Gas Department, and his Committee, I have had an opportunity of examining the hot-patching of retorts by blow-pipe spray welding at the Birmingham Works, and also of trying out the process on my own Works. The blow-pipe used is similar to that in use in Birmingham, but on account of the difficulty in maintaining a constant feed of cement I have used a vibrating container, depicted in Figures A and B. The container is similar to one used in Birmingham, but is suspended in a frame by four springs, the oscillation being effected by means of a fractional horse-power motor with variable throw crank and connecting rod attached to a fork on the under-side of the container. The most effective throw appears to be 1/32 in. This container has enabled us to deliver to the blow-pipe fine particles of cement which I think are more easily fused.

The period over which the process has been tried at Smethwick is not sufficiently long to give a considered opinion on the permanence of the weld, but I am satisfied from my own limited experience that leaks have been effectively stopped and that cement can be fused hard in the leaks, which should produce a more permanent repair than can be made with any other form of hot-patching.

At Smethwick we have found a carbon deposit in the gas space of the burner head, probably due to the dissociation of hydrocarbons, although I understand that at Birmingham this has not taken place. This may be due to the fact that at Smethwick the blow-pipe is kept in the retorts for considerably longer periods than is the practice at Birmingham, but the matter is being investigated thoroughly.

The AUTHORS, in reply, wrote: Mr. Green's remarks were greatly appreciated. The stalagmite formation he mentions has been met with by us, but can be successfully countered by the skill of the operator providing the cement is amenable to such treatment, as was seen in the samples exhibited.

With certain cements, when the burner is kept stationary the stalagmites or stalactites form in concentric rings, and



A B

Vibrating Cement Container.

gradually grow towards the burner and give a conical formation. The formal arrangement assumed by the stalagmites, etc., is probably brought about by the segregation or zoning

of particles which takes place during their flight through the flame, this being brought about by the varying velocities and temperatures of the concentric envelopes or zones of the flame in conjunction with the shape, size, density, and deformation of shape due to partial fusing of the particle.

If the semi-fluid particles when fused yield a fluid "melt," on striking the refractory they slide over one another and flatten out, but if a highly viscous or sticky "melt" is produced, they build up as stalagmites, due to causes suggested by Mr. Green. The phenomenon, however, is not confined to mixtures of flux and aggregate, but can readily take place with certain unit materials.

With regard to the question of intumescence, for this to take place bubbles of gas must be produced, the gas arising either from chemical reaction, or the expulsion of dissolved gases. If the melted material is viscous at the time of gas production the material intumesces and swells, and does not give a solid weld, but if the "melt" is very fluid the bubbles readily break up and a solid weld results. When materials are chosen which give no interactions which produce gas, the trouble does not arise.

The Authors greatly welcomed the support of Mr. G. C. Pearson, as he has given every encouragement for the development of the process. His remarks describe very lucidly the steps in the growth of leaks and the deleterious effect of leaks on both carbonizing plant, and results.

We are pleased to have Dr. Smith's helpful remarks, as we have always felt that the makers of continuous vertical retorts would welcome a successful dry welding process. In common with them we have realized that the present wet spray method would sooner or later give way to a more scientific process. Dr. Smith makes several useful remarks concerning cements and impregnated refractories. In reply to his query as to the permanence of repairs, it has been found that, after welding, small leaks have remained tight for several months.

Mr. Gaskill's remarks on his firm's experimental work on spray welding were exceedingly interesting. With reference to his question concerning the use of finer water-washed material, there is as yet insufficient experience to justify its use, but it is felt that finer material may enable the process to be accelerated somewhat if satisfactory feeding can be maintained. On the other hand, the size of particle now used may have just sufficient momentum to be concentrated over a small area; finer particles may spread and the concentration be lost. With regard to the mica used in our experiments, the variety Muscovite containing approximately 11 per cent. K_2O is the only one that has so far been tried.

Mr. Astbury asks a very important and searching question as to whether cracks develop later in the welded patch or its vicinity. We have no evidence as yet of cracks appearing in the neighbourhood of a weld, but sometimes a leak partially recurs where a large hole has been patched, while welds over small holes remain solid.

Mr. Hardiker's suggestion of vibrating the cement container to enable finer grades to be evenly fed is a good one, although the possibility of segregation of materials must not be overlooked. The Authors agree that quicker fusion of the particles should result, but concentration over a small area may be lost as previously mentioned. No difficulty has been experienced in Birmingham, however, in maintaining a constant feed with the container illustrated in the Paper, provided that the cement is carefully graded and thoroughly dried.

With regard to the carbon deposit in the gas space of the burner head, this trouble has not been experienced in Birmingham, but the explanation of its occurrence at Smethwick is undoubtedly correct; the deposit should easily be removable by blowing air through the gas space while the burner head is maintained at a dull red heat.

Mr. Currier's practical remarks are very helpful and encouraging. His forecast of probable improvements and the use of the process for coating refractories with special protective layers, etc., is thoroughly in tune with the Authors' ideas, and we are glad to know that such developments would be welcomed by gas engineers.

Some Results Attained with Solid Fuels Used in Open Grates for Heating Living Rooms

Communication No. 200

by

W. DAVIDSON, B.Sc., Ph.D.,

and

HAROLD HARTLEY, D.Sc.,

Central Research Laboratories of Radiation Limited

Mr. E. B. JOHNSON (Swansea) wrote: I first wish to compliment the Authors on the thoroughness they have displayed in carrying out such an interesting and useful series of tests on the best known but most inefficient of all solid fuel burning appliances. If efficiency is to be a deciding factor the housewife of the future will, on the data presented, select gas coke for the open fires, but there are other factors which have an equal, if not more important bearing on her choice. Such features as the easy ignition, silent burning, uniform heat emission over long periods before re-fuelling is necessary, and amount of ash and dust residue, are more readily measured by the ordinary user. For one or more of these reasons the lower volatile natural coals are now being used in increasing quantities for this purpose.

When the day comes that gas coke can be bought universally with not more than 2 to 3 per cent. of moisture and regularly under 8 per cent. of ash, we might expect to notice a reduction in the number of smoky domestic chimneys. Meantime, however, it will give satisfaction to know on good authority that even the lowest volatile anthracites give very good results in open grates. My own experience indicates that even the lowest volatile anthracites can be burned on any type of stool or bar grate, providing a thick fire is maintained. Incidentally, the ash-pit loss when using $\frac{5}{16}$ in. space bars compared with $\frac{7}{16}$ in. as used in the tests reported, is very small if poking is avoided and any surplus ash removed by passing a hooked poker or rake between the bars from beneath.

I would also like to point out that, according to the leading authority on Welsh anthracite and the current commercial standards, the volatile matter contents for fuels 10, 11, and 12 should read 5·4, 6·6 and 7·3 per cent. compared with 3·9, 5·3 and 7·2 per cent. respectively, as given in Table I. Such differences are frequently reported by outside investigators, although it is exceptional to find a lower figure than that generally acknowledged to be correct. Such differences, however, do not alter the findings reported by the Authors and this comment is given for guidance only.

Mr. L. W. ANDREW (Gas Light and Coke Company) wrote: I, too, would like to thank the Authors for a Paper giving in such detail their tests on solid fuel fires. Such tests are necessarily complicated and it is of immense value to have available this information which establishes over a reasonable range of conditions the relative radiant efficiencies of coal and coke fires.

There are inevitably in such a Paper a large number of points which are controversial but are not of particular significance with regard to the conclusions of the Paper. I have, however, two comments which I consider must be made as they affect the conclusions which the Authors draw in Section

VI, especially the statement that gas at 4d. per therm should prove more economical to use than coal at 2d. per therm. This statement suggests that there is only a small margin in favour of gas at 4d. per therm compared with coal at 2d. per therm, whereas I think that it would be nearer the truth for normal household use of the fires to quote gas at between 5d. and 6d. per therm to correspond with coal at 2d. per therm. In order to justify this different conclusion there are two points in the Paper which I should like to discuss.

Firstly, we have recently carried out at Watson House a fairly large number of tests comparing coal fires with gas fires under identical test conditions. As a result of these tests we are in complete agreement with the Authors concerning the overall gross bench efficiency of a modern gas fire and also in agreement concerning the relative on-the-floor radiant efficiencies of coal and coke fires. Unfortunately, however, equally consistently the absolute value of the radiant efficiency which we obtain for the solid fuel fires is about 1/5th lower than the figures given by the Authors. There are so many variables in the testing of solid fuel that it is difficult to point out the particular conditions which would account for this discrepancy. The actual test method was different as the thermopile was used instead of the integrating radiometer. On the other hand, although the well fire and barless stool fire were used as typical modern fires, these were different fires from those used by the Authors; also the coal we used, Derby Brights, with a calorific value of 14,000 B.Th.U. per lb., obtained in London, was different from the coal used by the Authors and obtained in the Midlands. Again, even with the same type of coal graded to the same size and used apparently in the same way by two different people, it is possible that the different technique adopted would mean a different speed of ignition of the fire and a different ultimate radiant heat output.

Less Favourable to Coal.

It seems possible that the technique we have adopted at Watson House has for some reason been less favourable to coal than the methods the Authors were able to use. We were certainly not expert in the handling of coal and all we could do to be as fair to coal as possible was to obtain from the manufacturers of the coal fires exact instructions concerning the initial load, method of stacking, and rate of refuelling, which as a result of their experience would give the best possible result with their particular grate. If, as a result of these variables, radiant efficiency figures are obtained so much lower, then surely in practice the ordinary housewife is going to get an even greater variation in performance, and it is unlikely that her technique will be more favourable to coal than the technique adopted by the Authors in their laboratory. One would therefore expect that in practice the figures quoted would be a definite maximum value.

Secondly, if we take the Authors' figures for overall radiant efficiency as being correct under home conditions, an even more important point arises as to whether the interpretation of these figures in terms of relative running cost is reasonable. I would like to refer to the following sentence in the Paper: "The gas fire is much the easier to regulate and will probably be used more effectively than the solid fuel fire, but the cash value of this advantage cannot readily be assessed." Although the Authors appreciate the importance of the flexibility of the gas fire they do not attempt to give a cash value to this factor although they quote cash figures for the comparison of solid fuel fires and gas fires. I do think that the difference between a gas fire and a solid fuel fire is so much a question of control and flexibility that this point should be emphasized and some value must be given to it if a practical cost comparison is to be made. Consider only two aspects of this flexibility:

1. If a room and the occupants of a room are to be heated under any particular condition then there is a certain heat output which is most suitable. If too much heat is provided then the consumer is paying more in order to be less comfortable; on the other hand, if the heating is inadequate, there is no comfort whatsoever. If a gas fire is used then it is much more likely that the consumer will regulate the fire to approximate reasonably accurately to the desired comfort conditions. The coal fire, on the other hand, in spite of years of experience may well give a heat output differing widely from the ideal. Particularly during comparatively mild weather the coal fire will consistently overheat the room although there will, of course, be spells when the room is under-heated during refuelling. On the basis of the Authors' calculation, although the average level of heat output of the coal fire is too high it would be credited with the whole of the heat it gives out during the period of occupation, and a gas fire for comparative purposes would be required to give exactly the same average heat output as that given by the coal fire. This seems to me to be unfair to gas; the gas fire is being credited with all the disadvantages of variable heat output of the coal fire, and one hates to imagine the heat output of the gas fire following the undisciplined output of the coal fire instead of giving a steady heat output most suited to the particular circumstances. It would surely not be unreasonable to credit gas with, say, a 20 per cent. saving for this factor alone.
2. A more definite saving of the gas fire compared with the solid fuel fire is due to the closer correlation of occupational period and the period during which heating is obtained. Even if the occupant of a room knows beforehand exactly how long a room will be occupied, it is still difficult to arrange the initial ignition and the refuelling of a solid fuel fire so that comfort is given during occupation and there is a minimum of fuel wastage before and after the room is used. On the other hand, it frequently happens that the occupant is unexpectedly called away from the room or has an unexpected change of plan. Under such circumstances the amount of fuel that will be wasted in the fire will be large, whereas in the case of gas, of course, the fire is simply turned out. Again, careless loading of a solid fuel fire may lead to considerable waste.

   It is probable that during a day at least 2 lb. of coal would be wasted and this represents on most of the tests given by the Authors a waste of the order of 15 per cent.

I hope the Authors will excuse this criticism of their results on relative running cost and appreciate that it is not in any way meant to detract from the very real value of the Paper as a contribution to the performance of coal and coke fires. I do, however, feel strongly that practical tests must be carried out to see what really is happening in the living room in the home as far as fuel cost is concerned. In the meantime, I hope the figure of 4d. per therm as a suitable price for gas to compete with coal in the open fire will be treated as very pessimistic from the gas point of view, and it will be realized that with equal justification this figure could be increased to 5d. or 6d. per therm.

Care in Production of Coke.

Mr. G. H. FUIDGE (South Metropolitan Gas Company) wrote: This work, which has obviously been carried out with care and precision, confirms in general the results of previous workers on this subject.

The Authors have done useful work in drawing attention once again to numerous factors which can affect the performance of coke in open coke fires and the consequent necessity for special care in the production of coke for open fires. Many present will know that the London and Counties Coke Association has recently issued a memorandum to its members on the subject of the production of domestic coke, and this memorandum contains suggested standards not only for grading but also for moisture and combustibility. The Paper reminds us of the importance of the combustibility of the coke as regards its use in open coke fires, a fact which is probably not sufficiently recognized. It cannot be too strongly urged that some such test as the C.A.B. or Volatile Therm Test should be applied to all domestic coke. Although efficient grading is essential, this alone will not produce a good domestic coke. However, the manufacturers of coke grates must also do their part. With certain types of carbonizing plant it is difficult and even costly to produce a highly combustible coke and therefore coke grates must be designed to give satisfactory results with coke of reasonable combustibility and not merely with the most combustible cokes; otherwise, complaints are likely to arise which are naturally attributed to the fuel but which are really due to unsatisfactory grates. Moreover, coke is by its very nature a variable material, and however much care is taken in the

control of coke quality there are bound to be some variations in combustibility. It is important that these unavoidable variations should not give rise to difficulty in use. The London and Counties Coke Association has had this point in mind in compiling a list of "approved appliances" which are found under test to give satisfactory results with gas coke of normal quality.

Referring now to details of the Paper: Table 1, which gives the characteristics of fuels used in the tsets, shows that the moisture content of the cokes varied over a wide range. The moisture contents of the cokes used were all high and should not be regarded as typical. Most London companies, for example, produce domestic coke with a moisture content consistently between 3 and 5 per cent., a proportion which is just sufficient to prevent dust nuisance. It appears that the cokes were used in the wet condition, which I think is unfortunate. It would have been preferable to have dried the cokes to a reasonably uniform low moisture content and to have determined the effect of moisture as a separate study.

It is mentioned that the ash content of coke No. 5, 10·5 per cent., is much too high for domestic coke. This statement is rather too emphatic; 10 per cent. should certainly be aimed at as a maximum, but in these days when gas companies have little control over the quality of coal purchased, it is rather dangerous to state that this figure is "much" too high. In any case, work by the South Metropolitan Gas Company, H. J. Hodsman, and others has shown that the important property is not the percentage by weight but the nature of the ash, and this can be expressed conveniently in terms of percentage by volume. It is possible to have a coke with a low percentage of ash by weight but a high proportion by volume which produces a dull dirty fire, whereas another coke may have a high proportion of ash by weight and a low proportion by volume and produce a clean bright fire.

The Authors find that the chimney pull has no effect on the performance of an open coke grate, and this agrees with work carried out in my Company's laboratories. It must, however, be remembered that the chimney pull may have a large effect on the comfort conditions in the room in which the fire is situated, and complaints of inadequate heat from a coke fire have frequently been traced to an excessive rate of air change through the room; this has been corrected by fitting a restriction in the flue.

I am somewhat surprised that in their work on the effect of size of coke on its performance, the Authors find a reduced efficiency from the large sizes. I would expect the reverse to be the case, since with the large size of coke a smaller amount of producer gas was formed and, as the result, the fuel reached a high temperature. Can the Authors give a reason for this reduced efficiency?

There are so many factors which enter into the problem of space heating apart from the radiant efficiency of the fire that it seems a little dangerous to make calculations of cost of heating based upon laboratory determinations of efficiency. Probably the only true test for comparative cost is to use the fires in domestic houses under normal conditions of use. Owing to the far greater flexibility of gas and with modern methods of two part charge, the relative costs of heating by gas and by coke are quite likely to be appreciably different from figures based on laboratory tests.

Comparison of Fuel Costs.

Mr. F. O. HAWES (Tottenham) wrote: The Authors are careful to state in Section VI that it is difficult, using laboratory results, to make close comparisons of fuel cost. They will therefore be interested to note that some practical comparisons, made about five years ago, closely agree with the relative costs which they assign to coal and coke fires.

In the comparisons referred to, two members of the Tottenham technical staff, who were at the time using coal in their homes, made accurate measurements over a period of three weeks, of the fuel used, hours of burning, and outdoor and indoor temperatures. The coal burning grates were then replaced by coke grates and similar data collected over two further periods each of four weeks. Very fortunately, weather conditions were such that the same difference between indoor and outdoor mean temperatures was attained all the time.

The result in these two homes of different sizes was that coal was dearer than coke by about 40 per cent. in each case, using the prices given in the present Paper.

A recording thermometer shielded from direct radiation was used in one of the rooms, and the interesting observation was made that the drop in air temperature on refuelling was quite marked with the coal fire but was scarcely visible on the record when coke was in use. This was put down to the greater heat capacity of the coke grate and its surroundings, which continued to radiate at almost the same rate although the actual fire surface was temporarily shielded by fresh fuel.

A Pressing Problem.

Mr. JAMES JAMIESON (Edinburgh) wrote: The publication of the results of this important and exhaustive investigation is most opportune, coming as it does when we are passing through one of those acute periods of depression which seem to shadow the market for coke.

A stable market for coke is one of the most pressing problems before our Industry, and if a regular and economic outlet is to be found I agree with the Authors that the open fire of the domestic consumer is most attractive. The domestic grate, however, has many peculiarities which are accentuated when fuels less reactive and less dense than coal are used. Gas coke made in continuous vertical retorts, for instance, although in some respects an excellent fuel, cannot be used indiscriminately and much money and work will have to be expended before high temperature gas coke will be extensively established in the open hearth.

It is true that by the careful selection and blending of coals and by the scientific preparation, grading, and handling of the coke many of its disadvantages will be eliminated, but the ultimate solution will, in my opinion, come only through the installation of grates designed and constructed for the purpose, and that will not be easily accomplished. For that reason I consider the Authors were justified in adopting for their investigation the most efficient grate and the most suitable size of fuel for each of the fuels tested.

Recently we inaugurated a hire-purchase scheme for the installation of coke burning grates. Before doing so we tested practically every known grate on the market and only two were passed as satisfactory.

In two cases grates which were recommended to us and which are popular and have an extensive sale in the London districts would not function reasonably well on any of the grades of coke which we can supply. That is again indicative of the many difficulties which the domestic heating market presents and the care which will require to be exercised in the development of it with gas coke produced at high temperature.

High bulk density, in my opinion, is one of the most important requirements of a solid smokeless fuel, and its attainment in continuous vertical retorts with the coals commonly used for gas manufacture in Scotland is only possible by the sacrifice of other advantages such as ignitability and the rate of recovery after refuelling. It is a factor which does not arise in many of the older fireplaces, however—the grate capacity when used with coal being reduced by the installation of side bricks. Nevertheless it appears that if we are to tackle seriously the requirements of the domestic market a number of grades and sizes of fuel will require to be handled. That does not simplify the problem which is already bristling with difficulties. The experience of the Authors on the effect of chimney pull is contrary to our experience when working on natural draught, and we have to suspend testing during periods of high gusty winds as otherwise we do not get reliable results. Would the Authors agree that the explanation lies in the method of test and that, while little effect is produced by a lowering or raising of the normal rate of flow of chimney gases, providing the rate is kept constant, some effect would be apparent if this were of a fluctuating character over the period of any particular test?

In our grate test we allow the fire to burn out, whereas the Authors refuelled when radiation dropped to a predetermined value. They also make allowance for unburnt fuel left in the firebars but none for fuel which has fallen into the ash-pan. In our case we make no allowance whatever for unburnt fuel. Will the Authors say if the idea is that the fuel left on the bars would normally be available for use after refuelling? We have found this residue to be very useful in actual practice when using our special free burning coke.

The Authors assume the period of useful heat as being the time during which the fire is emitting radiant heat at a rate equal to or in excess of 50 per cent. maximum intensity. This must only be arbitrary, since the minimum useful heat will differ for practically every fuel. Our procedure is to measure the time of intense fire, this being the period during which the intensity is about 250 B.Th.U. per sq.ft. per hr. in test position. Intense fire is therefore the same for all fuels and is reckoned to represent adequate heat for comfort.

I was interested in the remarks of the Authors on pitch coke as we recently had a consignment for test. The test sample was graded 1 to 1¼ in. and had a lustrous porous appearance not unlike retort carbon. The proximate analysis was:

	Per Cent.
Moisture	1·7
Volatile matter	5·2
Fixed carbon	92·1
Ash	1·0
	100·0

The coke was readily ignitable and produced a pleasant and cheerful fire of high intensity which burned with a fairly copious luminous flame. It was somewhat marred, however, by the fact that as the pieces of fuel were warming up dense black smoke was given off and that objectionable crackling, which was sometimes explosive, occurred with the expulsion of small pieces of fuel from the grate. This crackling characteristic of carbonized fuels is worthy of investigation. The period of intense fire for the pitch coke was 135 min. compared with 82 min. for our standard fuel. The fire faded out in remarkably sudden fashion, however, leaving a black residue unlike ordinary ash.

We have asked the makers of coke to carbonize a mixture of pitch and a good quality of coke breeze which should produce a fuel easily ignitable with a reasonably high bulk density and an ash content under 3 per cent.

Room for Dispute.

Mr. C. A. MASTERMAN (Gas Light and Coke Company) wrote: As several speakers and as the Authors themselves have emphasized, there is ample room for dispute in translating radiant efficiencies of fires into comparative costs for different fuels. This fact does not in the least diminish the importance of the research results reported in this Paper, which will be of permanent value to those concerned with the development or improvement of coke fires.

I am, however, extremely doubtful of the reliance that can be placed upon the Authors' interpretation of these results into practical comparative figures, especially so far as gas is compared with solid fuel and where the circumstances of operation are so different. In illustration, the Authors conclude in Section III that the effect of chimney pull on solid fuel fires is small, whereas in Section VI they make the assumption that the effect of chimney pull on the radiant efficiency of gas fires is large; our own results do not support the latter contention as a general rule, but, even if it were so, other factors of perhaps more importance will affect comparative costs and the users' comfort in his own home. It cannot be claimed that excessive draught in the flue in the case of a solid fuel fire is other than a waste of heat by removing large volumes of warmed air from the room which are replaced by cold air, with perhaps the added disadvantage of cold draughts. While the gas fire properly connected to this same flue will allow adequate ventilation. it will diminish excessive ventilation and so, in these special circumstances, perhaps more than offset the diminished radiant efficiency if the fire is of a type suffering from this disadvantage.

It is remarkable that this question of domestic room heating, representing as it does a bigger heat requirement than all other domestic heat purposes together, should have been so inadequately explored by practical trials. Col. W. M. Carr, in his comments on the 4th Report of the Research Executive Committee, drew attention to the need for trials on this subject and this Paper emphasizes this need. The form of these trials should be severely practical, involving as they should not only different types of room, climatic conditions and comfort level, but also different types of room occupant and use.

I would like to express a doubt regarding the inference drawn on p. 6: reference has elsewhere been made to the low incomes of the great majority in this country, with the suggestion that the great majority have no margin of purchasing power for greater comforts or luxuries. While I would be the last to ignore the importance of comparative costs in determining the future of various fuels, it does need to be emphasized that expenditure is not determined by gross income but by marginal purchasing power, which is a very different thing. Our own records show, for instance, a large number of expensive "de luxe" cookers to be found in the homes of many who, on a gross income basis, could be shown statistically as below the £5 per week limit. A sales and development policy of the Gas Industry founded on the supposition that 85 per cent. of the households in this country "can little afford to pay for personal conveniences" would in my view be most ill-designed. Nevertheless it is a fact that as an Industry we are the sellers of two smokeless labour-saving fuels, one or both of which will in any given circumstances be cheaper than coal. This fact, as I believe it to be, has yet to be proven beyond dispute by some such practical trial as I have suggested, which would then make clear that the coal fire is not the economical form of heating most people assume, but a luxury form which few can afford.

Complete Gasification of Coal and Methane Synthesis

Progress Report of Experiments at the Fuel Research Station

by

J. G. KING, B.Sc., Ph.D., F.I.C.,

Chief Chemist, Fuel Research Station, Department of Scientific and Industrial Research

Communication No. 197

Dr. J. G. KING, in reply, wrote: Dr. Dent's observations upon the relative merits of hydrogenation and methane synthesis are most interesting. As he realizes himself, his comparisons are somewhat speculative at our present state of knowledge. It is most important, however, that we, who are interested in the research, should be alive to the relative importance of each line of attack. In making calculations of thermal efficiency at present we are handicapped by having to make assumptions in the absence of direct knowledge. I may have made different assumptions from Dr. Dent, but my calculations show that there is no great difference in the volumes of rich gas which can be made by either process per ton of coke. Dr. Dent suggests that methane synthesis might constitute a more flexible process than hydrogenation. I agree with him that this will be so if we are able to produce a flexible catalyst. At present we are postulating a methane catalyst resistant to sulphur; in the presence of sulphur this catalyst will not synthesize liquid hydrocarbons. Also, it is not certain that a catalyst which has been used at 350° C. will work at 200° C. to make liquid products. However, we may eventually find a catalyst sufficiently flexible for both purposes. If not, it would not necessarily be impossible to change over the catalyst at short notice. As Dr. Dent concludes, only continued investigation will answer all our questions.

Institution Gas Fellowship Report, 1936-38

The Influence of Furnace Atmospheres on the Scaling of Mild Steel at Temperatures from 1,200° to 1,400° C.

Communication No. 196

by

A. ALAN TAYLOR, M.Sc.Tech.,

Institution Gas Research Fellow,

and

J. W. COBB, C.B.E., B.Sc., F.I.C.,

Livesey Professor

Dr. U. R. EVANS (Cambridge University) wrote: The valuable research described in the Report is particularly interesting in connexion with the light thrown on destruction produced by sulphur compounds. It may profitably be read in connexion with the work of Houdremont and Bandel,* which refers, however, especially to heat-resisting steels containing chromium and nickel. Here steels which are resistant in the absence of sulphur are attacked readily when much sulphur dioxide is present, owing to reduction to sulphur and fusion of the sulphide. It should be noted that nickel sulphide has a low eutectic temperature (645° C.); but, even below the temperatures at which the sulphides become liquid, extensive attack takes place, owing to the ready permeability of sulphides as compared with oxides. On these materials, attack by sulphur compounds is favoured by reducing conditions, and may actually be diminished when oxygen is in excess.

The new results of Taylor and Cobb show that the action of sulphur dioxide on ordinary mild steel is complicated. They attribute, doubtless correctly, the rapid attack about 1,000° C. to the fact that the sulphide oxide eutectic lies just below that temperature; here we are evidently concerned with reduction to sulphide. At 1,200° C., however, the effects of sulphur dioxide and oxygen are additive, whilst at 1,300° the combined action of oxygen and sulphur dioxide is stated to be greater than the sum of the two individual effects. It seems a little doubtful whether this would be expected if the sulphur dioxide has to be reduced to sulphur before it attacks the metal. A possible explanation of the accelerating action of sulphur dioxide in fully oxidizing conditions is one I proposed tentatively some years ago.† I suggested that traces of sulphide or even sulphate were formed momentarily, which, being unstable at that temperature, quickly decomposed, leaving secondary oxide in relatively non-compact form; clearly a small proportion of this secondary oxide would render the whole scale more permeable.

The Authors find that the relation between weight increment W and time t is given by $W^n = kt$, where n varies between 2 and 1, tending to diminish with the temperature and sulphur content. This is easily explained. If the film is of a protective character and neither melts away nor flakes off, the rate of increase, dW/dt, will clearly be proportional to $1/W$, so that $W^2 = kt$. If the film lacks protective character, or if it runs away molten or cracks off rapidly, the velocity of oxidation will be independent of time, so that $W = kt$. Under intermediate conditions we get $W^n = kt$, where n lies between 1 and 2, and, since either increasing temperature or the presence of sulphur compounds increases the permeability and the tendency either to melt or flake off, clearly these factors will tend to reduce the value of n.

Dr. J. C. HUDSON (Birmingham) wrote: In 1935 Mr. T. E. Rooney and I wrote as follows at the end of our contribution to the Review on Oxidation and Scaling of Heated Solid Metals (Department of Scientific and Industrial Research, p. 64):

"It is clear that, although much work has already been done on the oxidation of iron and steel, the whole subject requires much more detailed and extensive study. Thus:

(*a*) The oxidation/temperature curves for iron and steel should be redetermined over a temperature range up to at least 1,400° C., since it is not uncommon for temperatures well above 1,300° C to be reached in steel-heating furnaces. . . .

(*c*) Further experiments on oxidation in gas and other combustion atmospheres could usefully be made, and in particular the effect of small amounts of sulphur gases in such atmospheres should be fully examined."

The present Report by Mr. A. A. Taylor and Professor J. W. Cobb, together with the 1936 Report by Mr. H. C. Millett and Professor Cobb, go a long way towards making good these deficiencies and the Authors are to be congratulated on their careful work, while thanks are also due to the Institution for supporting the research.

Great Practical Significance.

The experimental results submitted by the Authors can only be discussed in detail by the very limited number of research workers who have conducted similar experiments themselves, but it is clear that in general they should prove of great practical significance to the iron and steel industry. The results given in Table 7 and plotted in Figure 18 are among the most significant, since they show quite clearly that, at least under the experimental conditions of the Authors, the scale formed on mild steel in a neutral furnace atmosphere becomes molten round about 1,340° C. Although in my very limited practical experience I have never seen molten scale on steel ingots or billets in a reheating furnace, it should be noted that the general practice in British steelworks is to reheat these to temperatures of the order of 1,300° to 1,350° C. before rolling. In other words, the ingots, blooms and billets fall within a temperature range where variation in temperature of 10° or 20° may cause a very large increase in scaling.

For example, a steel bloom 14 ft. in length × 10 in. × 3 in., weighing about 12 to 13 cwt., might lie in a reheating furnace for as long as 80 min. before being withdrawn for rolling; the final temperature of the bloom might be 1,320° to 1,340° C. The figures given in Table 7 for 5 min. heating show that the gains in weight at 1,325° and 1,350° C. are 0·0243 and 0·0362 g. per sq.cm. respectively. Assuming a parabolic law, the corresponding figures for 80 min. oxidation are calculated to be 0·0972 and 0·1448 g. per sq.cm. Admittedly the bloom starts up cold but presumably the surface rapidly reaches the furnace temperature.

The difference in oxidation due to 25° increase in temperature is 0·0476 g. per sq.cm. The total area of the bloom in metric units works out at about 28,000 sq.cm. and its weight at about 600 Kg. The excess scaling due to the slight temperature difference is therefore 0·0476 × 28,000 g. or 1·33 Kg. of oxygen. Assuming that the scale contains 75 per cent. of iron and 25 per cent. of oxygen, this weight of oxygen corresponds to 4 Kg. of iron. This figure is for a neutral atmosphere as used by the Authors. It would not be unreasonable to assume that in practice, owing to the presence of sulphur compounds and possibly of oxygen in the combustion atmosphere, the scaling loss would be increased by 50 per cent., *i.e.*, to 6 Kg., representing 1 per cent. of the weight of the total input.

Now, under modern conditions of steelworks practice, losses of 1 per cent. are appreciable and have to be taken into account so that *a priori*, assuming that the Authors' results are immediately applicable to steelworks practice, they have established a very important fact, which will render it desirable to control even more accurately than hitherto the temperature of the products in the reheating furnace, since the calculated effect is caused by a difference of only 25° C. It should, however, be pointed out that the practical man may have to take other factors into consideration and that the increased scaling loss may be offset by a decrease in the power consumption at the rolling mill or by the ability to reduce the bloom to a greater degree without reheating. Be this as it may, the fact remains that the best works practice

(*Continued on p.* 651.)

* Inst. Assoc Testing Materials, 1937, 163. Jernk Ann., 1937, **121**, 64.

† J. Iron and Steel Inst., 1937, **115**, 510.

Welsh Smokeless Coals for Open Fires

Institute of Fuel Discussion

At a Meeting of the Institute of Fuel on Nov. 10, a Paper on "Welsh Smokeless Coals for Open Fires" was presented by Dr. Margaret Fishenden.

Introducing her Paper, Dr. Fishenden added that if there were to be a very considerable advance in smoke abatement quickly, all interests must help, because, although ardent smoke reformers might ask for legislation next week, it must be remembered that something like 30 or 40 million tons—it was difficult to arrive at the absolute figure—of coal was burned in the domestic grate each year, and if all that were to be replaced by coke and gas, it would mean trebling the existing gas-works capacity. It was obvious, therefore, that if smoke abatement were to be effected quickly, we must get all possible help from the different types of smokeless fuel.

Under the heading "General Conclusions" the Author stated that the experiments have shown that South Wales coals, over the whole range examined, are in every way suitable for use in open grates designed for burning gas coke.

When gas ignition was used, the coals burned up slightly less quickly than the best quality of open fire coke, and slightly more quickly than a number of open-fire gas cokes bought directly from various gas companies. When lighted with wood, however, the coals burned up even more quickly than the best quality coke lighted with gas.

The radiation emission per pound of fuel burned was in all cases higher for the coals than for cokes, on the average the advantage being about 1% over the best quality open-fire coke, and 16% over the other cokes. Anthracites leave a higher percentage of unburned residue, but this can be used for lighting subsequent fires.

The investigations described in the Paper were carried out by the Research Department of the Combustion Appliance Makers' Association (Solid Fuel), and subsequently transferred to the British Coal Utilisation Research Association under the supervision of a Joint Committee of the Monmouthshire and South Wales Coal Owners and the Coal-Burning Appliance Manufacturers, of which the Author is Chairman.

Discussion.

Captain J. G. BENNETT (Combustion Appliance Makers' Association) said he was glad that the merits of Welsh low-volatile smokeless coal had been brought before the Institute, and, through the Institute, before all who were interested, either as domestic consumers or as suppliers of fuel. Possibly the view that gas coke should be used had been very adequately pressed; that was a view to which he certainly subscribed, and he was very glad to think that increasing quantities of gas coke were used every year for domestic fires. He liked to feel, however, that we in this country had more than one string to our bow in meeting smoke abatement requirements. We had excellent gas cokes, and they would be still more valuable if only they were more uniform in quality, so that it would not be necessary sometimes to go through the very painful process of rejecting a coke. It was not so difficult to reject a coke required for an experiment, but it was rather painful to reject it when a householder had paid for it into his own cellar. As he had stated recently at a meeting of The Institution of Gas Engineers, if its quality were brought up to the high level which the best gas companies were able to show, the case for the more extensive use of gas coke for open fires would no longer be much stronger. Certainly, as Dr. Fishenden had shown, the low volatile Welsh coals were more consistent in performance, which was quite natural, as they were produced as primary fuels, whereas gas cokes were still, unfortunately, in the eyes of many sections of the Gas Industry in this country, secondary in importance to the gas.

Although there were those two strings to the bow with which they were trying to shoot at smoke production from domestic fires, it would be wrong to regard bituminous coal as an enemy in that respect; unfortunately, that was done sometimes. On the one hand, the figures that were very often quoted as to the smoke from bituminous coal, which figures were based on 40 or 50 year old researches, were misleading, because present-day fires were very much more satisfactory in that respect; and, on the other hand, methods of ignition were being developed which enabled a great reduction of the smoke to be effected.

Dr. C. H. NOTON (London and Counties Coke Association) pointed out that the L.C.C.A. was doing all it could to improve the grading and every other desirable quality of coke.

With regard to obtaining samples of coke for experimental purposes, he considered it a pity that the Combustion Appliance Makers' Association had diverged from the policy adopted when he was in that organization of obtaining a sample of an open fire coke from a gas company and informing that company that the coke was to be used for the purpose of comparative tests. In that way one was certain to obtain good coke. He did not think that if a member of C.A.M.A. had made a private purchase of 5 cwt. of anthracite Welsh nuts from a coal merchant, those nuts would have been quite so good as they might have been otherwise.

Mr. E. W. L. NICOL (L.C.C.A.) said his recollection was that, in the comparisons between coal and coke recorded in Dr. Fishenden's Paper of 1920, coke had shown a greater radiation efficiency than coal. He did not remember the figures exactly, but the efficiency of bituminous coal was given as somewhere about 24%, whereas the figure for coke was about 28%. The figures in the present Paper, relating to the comparison between Welsh coal and coke, reversed that order; but the figures in the present Paper relating to bituminous coal and coke were almost identical with those given in the earlier Paper. The experiments recorded in the earlier Paper were made before the advent of the coke grate, and therefore they had had to be made in coal grates. Commenting upon the Author's reference to the weights of unburned fuel remaining on the grate, he said that anthracitic coals were very friable when heated, and the loss through the grate, and especially through the coke grate, must be very considerable. Further, the fuel which fell through the grate would continue to burn on the hearth, generating quite a high temperature there, so that if Welsh coal were used he imagined that the grate would soon be destroyed.

Departure from Leeds Method.

Dr. F. J. EATON (Gas Light and Coke Company) said that whereas in her earlier work on the coal fire, described in her Paper of 1920, Dr. Fishenden had used substantially the Leeds method of determining the radiant efficiency of a fire, in her latest work she had departed from that method and the comparisons were based entirely on radiation taken in one direction only; the assumption was made that, since the fuels and not the grates were being compared, the ratio of heat output at one fixed point in front of the fire bore a constant relationship to the total heat output irrespective of the size or character of the fuel tested. Dr. W. Davidson and Dr. Harold Hartley, in their Paper giving the results attained with solid fuels in open grates, presented to the Autumn Research Meeting of The Institution of Gas Engineers in 1938, had shown that, using an integrating radiometer, the radiant efficiency on a coke grate of gas coke was 32-35%; of dry steam coal 26-29%; and of anthracite 26-30%. Since those results reversed the order of merit of the different fuels as given by Dr. Fishenden, Dr. Eaton asked whether Dr. Fishenden had any experimental evidence to support the assumption that the "distribution factor" was a constant for different fuels provided the same grate was used in each case.

In comparing fuels for domestic space heating, he continued, the question of cost must always be considered. We should all like to see smokeless fuels used extensively for open fires, but the majority of householders would not change to a smokeless fuel unless it were at least as cheap and more convenient to use than the smoke-producing fuel which it replaced. At the prevailing prices in London, dry steam coals were 41% more expensive than open fire coke, and anthracite of from 1¼ to 2½ in. square mesh was 43% more expensive than open fire coke. Further, with perhaps the exception of Great Mountain anthracite, natural fuels could not be handled without a considerable amount of breakage and the dust formed could not be used for banking the fire, first, because the coals used were non-caking, and, secondly, because the air spaces on coke grates were wide. It was not true to say that the results of efficiency tests obtained in the laboratory would be repeated in the home. Making a conservative allowance of 5% for breakage, the dry steam coals would be at least 48% and the anthracite at least 50% more expensive than coke. Moreover, both the dry steam coals and anthracite were more expensive than bituminous coal, which on

the average cost 20% more than coke in London. When it was known that the results obtained with the natural fuels were no better than those obtained with coke, he felt that the open fire was not a very hopeful outlet for dry steam coals or anthracite.

Mr. L. W. ANDREW (Gas Light and Coke Company) said that there must be a certain ideal heat input for any given room, and the comparative costs of using different fuels would depend not only on the radiant efficiency but also on the nearness with which the consumer could approximate to the desirable heat input. He would like to see the results of a comparison of coke and coal on that basis.

Mr. ARNOLD MARSH (Smoke Abatement Society) suggested that there were great opportunities for the development of the use of Welsh smokeless coals in open grates, and the work marked the beginning of a decidedly important phase in the smoke abatement movement. He did not think for a moment that the coke suppliers need be troubled about that development, because the whole difficulty at the moment was that there was far more scope than anybody was able to take advantage of. The development of the use of gas coke was dependent upon the development of the use of gas. He believed it was correct to say that at the present time the gas coke available for domestic purposes was not far from its limit. The use of coke from coke-ovens was also a possibility, again on special kinds of grates. But, whatever might happen in that direction, the movement for the use of smokeless fuels in new and special types of grates could be helped by the increasing use of Welsh coals. It was a big enough job to persuade people to make use of modified grates, and no matter how strongly the tendency developed he was afraid that a considerable period would elapse before the development could be completed. Therefore, there was need also for the development of the use of smokeless fuels which would burn satisfactorily in ordinary grates. Perhaps in the future it would be more desirable for gas coke to be modified to burn in ordinary grates on the lines followed in Liverpool, and to leave the coke grate more to the Welsh coals and the coke-oven product.

Dr. FISHENDEN, in replying, dealing with a question as to whether the cokes used in the experiments described in the Paper were in fact open fire cokes, said that open fire cokes were specially asked for. What more could the consumer do than go to one of the biggest gas-works in London and ask for open fire coke? The disagreement between the figures given by Davidson and Hartley, to The Institution of Gas Engineers, and the figures in the present Paper, was not surprising. Davidson and Hartley had given figures of 32-35% for the efficiency of gas coke; in the 1933 report to The Institution of Gas Engineers on the behaviour of gas cokes in the open grate the efficiency figures had varied from 27 to 36%. Undoubtedly one could obtain a wide range of results with a wide range of fuels; and one would imagine that Davidson and Hartley had used fairly good quality gas cokes.

Technical Education in the Gas Industry

A discussion by the London and Southern District Junior Gas Association, held on Nov. 8, introduced by Dr. J. N. LONG, Principal of the Westminster Technical Institute.

Dr. LONG opened the discussion by giving some examples of what he referred to as the "mechanism of learning." No piece of knowledge, he said, was of the slightest use to anybody unless he knew how to use it. It was no use a teacher talking to a class, and the class responding, unless at least 75% of that class were making the knowledge imparted to them part of them—so that it belonged to them. Some subjects were easier to learn than others, but in these days of repetition work practically everyone engaged in industry must acquire a sufficiently sound knowledge of the science underlying his daily work to help his industry forward. No matter what industry they were in they would find that there was a science underlying it; and even persons in relatively junior positions were bound to learn something of this underlying science in order to make any progress.

There would always be about 50% of people who would not bother about technical education or fitting themselves for their job. Some of them would make progress; but the majority would become ordinary workmen—not that he intended that in any derogatory sense. In these days they had to be more than just craftsmen if they wanted to get on. The process of learning depended upon the subject as much as upon the aptitude of the individual. It was their endeavour at the Westminster Technical Institute to arrange that the subjects in the curriculum were supplementary to one another. They tried to give an all-round training and not "swot" people up for examinations. The average person could not be taught by a text-book.

The value of the Internal Examinations conducted by The Institution of Gas Engineers, said Dr. Long, could not be overestimated. In such cases the staff knew their students and could make appropriate allowances, whereas the external examinee was merely a number to the examiner. It could not be in the best interests of the Industry or of the students to encourage them to take External Examinations. The Institution of Gas Engineers did not encourage External Examinations unless it was impossible for the student to take them in his own area. The difference between a London University Graduate on the internal and external sides was as wide as the poles. London was the only university in the world to permit a student who had not actually attended some of the colleges to take his final examination. Most of the criticisms levelled against examinations as being an unsuitable means of judging people had been levelled at the external system.

The PRESIDENT (Mr. S. C. Waldock, Gas Light and Coke Company) remarked that the Association had a representative on the District Education Committee, Mr. Prater, who was doing good work on their behalf. A good deal had been written and spoken on the subject of technical education in the Gas Industry, said Mr. Waldock; and he had taken the opportunity of reading Sir Frederick West's comments on the subject in his recent William Young Memorial Lecture. In that he referred to the need for Day Courses in the larger Technical Colleges so that students working and employed in the gas-works, and who sometimes had to travel considerable distances to the Colleges, might be able to attend classes on one day in the week instead of having to travel three times a week for evening classes, as was very generally necessary to-day. And for External Students, Sir Frederick had suggested the further development of tuition by correspondence.

Institution Ready to Help.

Dr. W. E. LE B. DIAMOND (Assistant Secretary of The Institution of Gas Engineers) said that they of the Institution were only too glad to receive any suggestions relative to the Education Scheme and to endeavour to help students in their work in every possible way. They did not always realize that the things they learnt, whether technical or general, were the tools with which they earned their living or enjoyed their leisure. Mathematics might be a very dull subject to a person not mathematically minded; but it assisted him to prove things and helped to train his mind.

Mr. R. N. LEFEVRE (Officer-in-Charge of Training, Gas Light and Coke Company, Watson House), in regard to Dr. Diamond's reference to tools, remarked that under the new Education Scheme, which they all agreed was excellent, the tools had been increased in quality; they were now tested and proved. In other words, the standard of ancillary subjects had been considerably enhanced, and students were expected to equip themselves with tools of the very best quality. It took five years to acquire those tools—and having acquired this first-class "kit" they sat for their Final Examination and found it was a job that could be done with a cheap screwdriver. Consequently they were losing interest—and the all-important thing in any Education Scheme was to maintain the interest of both teachers and students. On the Supply side there were two examinations, but the same Paper was set for both. This was unfortunate. There were, however, ways out; the examination could be divided into parts, and Gas Engineering (Supply) students could select so many questions. Better still, distinctly separate papers should be set. The standard of any Education Scheme was judged by the world at large and by the students in particular by the actual examination held at the end of it. He appealed to the Institution Examiners for a better standard of examination.

Mr. A. F. GRANT (Gas Light and Coke) said that any Education Scheme must be considered alongside a scheme for practical training in whatever department the student was engaged. In the choice of personnel, those who were to become gasfitters could be recruited from the Elementary Schools, whereas men with a greater brain capacity could obviously reach a higher standard and take more advanced practical courses; that was where part-time day classes came in. The man who was to become a works en-

gineer or chemist had a very long course, and if some scheme could be arranged whereby a student leaving school at the age of sixteen could go straight into a four-year practical training before going to college, this would give him a great advantage over the student who went straight to a technical college from school. There was a large field for investigation into a scheme for pre-graduate apprenticeship. The selection of foremen should be guided by some form of elementary theoretical education, instead of choosing the next man when a foreman retired, without considering whether he was fitted for the work. They could sort out different types of lad suitable for different types of work. It had been suggested that the Elementary schoolboy was better as a gasfitter than the Secondary schoolboy; but the Secondary schoolboy was capable of a higher type of job, and so it was better to use his greater capabilities to the fullest extent. Sir Frederick West was perfectly right when he said in his William Young Memorial Lecture that the Gas Industry was looked upon as a decadent industry. Unless they set out to train on systematic lines young men coming into the Industry they would never overcome this slur.

Difficult to Return to the Academic.

Mr. F. G. COOPER (Gas Light and Coke), referring to the suggestion that a man should have a four-year practical training before taking the theoretical course, said that after his four years of practical work his whole outlook became practical, and it was almost impossible to get back to the academic work. He started his own career on the works direct from school and later took his Degree Course in Gas Engineering. On taking the ancillary subjects he found the Papers and lectures boring. He felt that if a man could take a course successfully after doing his day's work he was deserving of the highest praise. In connexion with Dr. Long's reference to learning from text-books, Mr. Cooper said that this was the unfortunate position in which all External students found themselves. He had two sources of information—namely, Newbiggin and Alwyn Mead, neither of which was particularly up-to-date, and the Halifax Gas College—and in this respect he would like to pay tribute to the excellent work Mr. Coe was doing on behalf of the External student.

Mr. F. O. HAWES (Tottenham) said that there were very few Diploma Courses available except by correspondence. Quite recently a Course had become available at some of the Institutes; but until then Mr. Coe was the only man who catered for the Diploma student. In five years of evening classes one could not cover the whole subject; Dr. Long had suggested, however, that in five years he could teach the subject of gas technology. All the teacher could do was to show them how to study; after that they had to return to the text-book. For the man who had had a good Secondary school education and attended evening classes as well, working from text-books was not an impossibility. It was not so bad as taking up study again after having spent four years on the works. At College people set out to take their Degrees, and even a Doctorate, in the same stride as their term examinations; but the man who went on to the practical side for even a short period was at a great disadvantage. A member from the North-East coast raised the question of day classes in The Institution of Gas Engineers discussion on the Education Committee's Report; but he did not think anyone present received the suggestion with enthusiasm. If an undertaking released a man for day classes they did so with the idea of training him to take up a responsible position with them. As often as not, however, after they had paid for this man's training, he moved to another undertaking who reaped the benefit. That, he suggested, was a considerable bar to day courses.

Mr. GRANT observed that when he spoke of a student undergoing a practical training directly after leaving school he had in mind an apprenticeship scheme coupled with day classes. Men from such courses were setting the standard in Honours Degrees, and he regarded this as the ideal way of coupling theoretical and practical training.

Education of the Outside Salesman.

Mr. R. E. TENNYSON-D'EYNCOURT (Tottenham) said that he went to the Westminster Technical Institute at a relatively advanced age, and until then he never realized how interesting technical education could be. He was surprised to find that his younger colleagues did not appear to take the courses as seriously as he did. Perhaps this was because his own outlook had changed; but he did feel that practical experience in any form gave one the ability to acquire knowledge which one might not previously consider of any real value in the work one had to do. One of his real concerns was some form of education for the outside salesman. The average outside representative—particularly the man who started as a salesman—was apt to take the easiest course because he was frightened of the harder one. It was in the interests of the Industry to-day to educate that side of their personnel. A man's real interests were often centred round his hobbies. Men were tackling in their own time abstruse and highly technical subjects. The majority of people engaged in any sort of work were not inclined to give of their best in that work, but rather saved it up for their own time and their hobbies. Child education to-day was concerned with making one's studies part of oneself. Their education was being directed to showing how their knowledge could be used. It raised the question of how one could give the salesman such as he had suggested some form of education which would show him how interesting and useful knowledge could be made.

Mr. S. J. HOLGATE (Gas Light and Coke) said that training should be aimed at covering the job a man was doing or preparing him for something beyond it. The man taking the two subjects on the Supply side was often engaged in some other sphere which did not involve him in the practical application of those two subjects except when he was in the classroom. He did not always want the intense detail contained in the ancillary subjects. Rather did he require training in the ability for logical thinking. The standard of the ancillary subjects should be lowered accordingly, and elementary and commercial economics relating to the Gas Industry should be added. For instance, they all had in their minds what they regarded as a reasonable price for, say, a gas cooker. This had nothing to do with supply and demand or the cost of production; it was unscientific. In common with the general public they thought that certain appliances were too expensive regardless of the costs of production. If elementary economics relating to the Gas Industry were included in the course at the expense of other ancillary subjects it would fit men better for administrative positions.

Mr. J. M. GRAMMER (Gas Light and Coke) agreed with Dr. Long that it was impossible to learn from text-books alone. It was, nevertheless, essential that students should read the Technical Press and make summaries for themselves of technical articles and be able to cross-examine their lecturers when the time came. This made a useful contribution to the successful running of classes. Some students only saw their lecturer once a week. At evening classes students could not hope to cover the whole subject merely by listening to what the lecturer had to say. The most the lecturer could do was to give certain essential details and refer the students to sources of study. He could not understand why the two Supply Papers were so much alike. Would it not be better for the second Paper to be of an entirely different character? One Paper could be theory and the other design.

Recommending the Impossible.

Mr. G. BURCH (Gas Light and Coke) said he thought Mr. Grammer was recommending something which most of them found absolutely impossible. The majority of them were employed during the day and were expected to do a good day's work. If they compared themselves with students in other industries, some of whom were sitting for their Intermediate Science or Arts, it would be found that these students had practically the whole day at their disposal. He was interested in Mr. Tennyson-d'Eyncourt's experience of commencing study after some years of practical work. He did not suggest that it should be necessary for the junior entering the Industry to wait three or four years; most of them came into the Industry from school where they had been accustomed to hard study and examinations. Mr. Tennyson-d'Eyncourt's suggestion would be very valuable, and during that period the junior should have every opportunity of taking part in organized work—not just filling up his time doing some other man's job to get practical experience. When he came back to technical education after two or three years his interest would be easily revived. Many who took these examinations were "pitchforked" into taking them without much choice, and many of the subjects they had to study had very little interest to them. The result was that they were apt to become a Jack of All Trades—and master of none.

Mr. W. H. LAYTON (Gas Light and Coke) said he felt rather worried when, after five years' study, the Institute produced two more ancillary subjects. Also, he found it practically impossible to assimilate all the articles appearing in the Technical Press.

Mr. CLAXTON said he had spent ten weeks learning the differential calculus, which was equivalent to 20 hours' work. In the Inter-Science course for the university the same subject, only going up to totality curves, occupied three terms. He did three three-quarter hour periods a week, together with one hour a week of private study, making a total of 117 hours. No student, he claimed, could cover the subject in 20 hours. So even the tools were snatched out of their hands before they could use them.

Mr. J. MALSBURY (Tottenham) said that the type of text-book varied very widely. Out of seven First-Class Diplomas, the Halifax Gas College claimed five, which seemed to be a definite enough answer to the text-book argument. He would warn Mr. LeFevre to be cautious in his reference to first-class tools. If everybody used first-class tools there should be NO failures—which was by no means the truth. He suggested that elementary economics was just "horse-sense."

Mr. LEFEVRE observed that it cost something like £400 a year to go to Oxford. The Westminster Technical Institute cost 30s. per annum, equivalent to 4d. per night or 2d. per hour. At Oxford students might see their tutor once a week—fourteen times,

at £10 per time!—and then he would merely direct their studies. The remainder of the time they might do what they liked. They were on their honour to work with their fond parents paying the fees and hoping that they were doing so. At the Westminster Technical Institute not only did they get their money's worth but also good tuition. The teachers gave them a lead, and they were expected to do a certain amount of work for themselves. There were students attending classes to-day who were doing homework, becoming efficient soldiers in the Territorial Army, playing games, and able at the same time to carry on a perfectly happy social life. It could be done, and many did it.

Training of Teachers.

Mr. T. G. NOBLE (Gas Light and Coke) said that students had some very real complaints. Dr. Long had said they had the best teachers they could get. As one of them he found it difficult to refuse this flattery, but he was a little doubtful about it. They had spent two hours discussing training people to do a job; yet there was no preliminary training required before one could teach at a Technical Institute. That seemed to be a serious weakness, because teaching was a specialized process. He did not wish to suggest that any of them did not do their best to be good teachers; but it was a little odd that no special qualifications appeared to be required. Some students had complained about the quality of the teaching. They had spoken of the difficulty of learning from text-books, continued Mr. Noble; many students complained that their teachers simply read out of text-books. Such teachers were no better than the text-books themselves. If a teacher was to have the privilege of examining a student, equally should that student have some say as to whether the teacher met his requirements.

Mr. H. G. S. LINCH (Gas Light and Coke) said that some years ago he took the Major Course and got as far as the Ordinary Grade. Then, for various reasons he was unable to go any further. He would have been very glad if there had been a little encouragement from The Institution of Gas Engineers to continue with the Higher Course by the correspondence method. Many engineering bodies made it possible for students to obtain qualifications by such methods; yet he could not find a correspondence school prepared to offer instruction in the Higher Grade Course in Gas Engineering. In his case he had to decide whether he was going through the rest of his career as a "half-baked" technician or try to become a first-class salesman. So he took a correspondence course in Sales Management, and he believed that course had given him sufficient knowledge to make use of the excellent technical information available to the gas salesman and to enable him to carry out his own job in a better way. One of the things he particularly appreciated was the ability to understand the instructions and schemes that emanated from Chief Office—and he did not intend that in any facetious sense. It would be a very good thing if all salesmen were encouraged to take a course in Sales Management.

Mr. PEARSON pointed out that The Institution of Gas Engineers and the Technical Institutes were providing the means to sharpen their bayonets; but was the Industry only allowing them to cut butter?

Directing Studies on Right Lines.

Mr. L. J. SMITH (Gas Light and Coke) said that a great deal more could be done to direct students' studies along the right lines. At times many of them were in difficulties as to which course it would be best to follow having regard to their particular job. Many apprentices wasted three or four years' study through not being directed along the right lines. He was personally aware of that fact; it had been his misfortune to follow the wrong course of study because he had not been given a definite lead. He was in somewhat of a quandary because ten years ago he took up a certain course of study and obtained a certificate; but the subject he wanted now was quite different from the one he studied previously. It would take him five years to qualify for the subject he wanted now, and he thought he might be excused a great deal of this. It would be helpful if there was someone available to advise apprentices more than was done at present.

Mr M. A. GRIFFITHS-JONES (Gas Light and Coke) also made a plea for some form of sales economics to be included in the courses. There had been a tendency lately for the Supply Course to be taken by salesmen, which made one wonder whether that Course was really best suited to their needs—that was, assuming that it was intended for them. He was not disparaging the ancillary subjects, but he thought the average salesman, having taken the Supply Course had very little idea of the difficulties of sales management in general. He also suggested that lecturers should write out their notes and distribute them to the class, as the students' own notes were usually rather hurriedly put together and might be inaccurate.

Mr. HAWES said they must not lose sight of the fact that the Education Scheme was started by The Institution of Gas Engineers as a preparation for people who should become corporate members of that body. Although he was on the Engineering side he could appreciate the objections of some people on the Supply side to the differential calculus being included in the course; but it must be remembered that the course was prepared for those destined to become not salesmen but distribution superintendents. The Institution had formulated not an Examination Scheme but an Education Scheme, because they could not examine a man to find out what he knew; they must know something of his training. Therefore, the examinations themselves were a relatively small part. The Institution of Mechanical Engineers' examination for Associate Membership comprised, first, a home Paper in which the examinee was given a problem of design and lay-out in mechanical engineering. Then there was a four-hour Paper on the bench with text-books, followed by a *viva voce* examination.

Value of Discussion Circles.

Dr. LONG, replying to points raised in the discussion, observed that most of the criticisms had been directed at the Institution Education Scheme. The Scheme they were running at the Westminster Technical Institute was the proved Scheme of The Institution of Gas Engineers, and if they wanted anything else they must tell the Institution about it. It was remarkable how much criticism there was of the Institution Scheme. He suggested that discussion circles on education would be worth while—and the Institution would be bound to listen. From his own personal experience as a works apprentice he could say that there was no type of technical education which was better than that provided by the local authorities. Such Colleges belonged to them as ratepayers, and they should take advantage of them. He would make a shrewd guess that the Diploma people had previous training at Technical Colleges.

A day course consisted of 1,200 hours; evening classes totalled 150 hours and involved the teaching of tired students by tired teachers. Of course, day classes were better, and it was an advantage to the undertaking to release men to attend them. If they passed on to other undertakings it was unfortunate, but it might be the fault of the undertaking if that happened. It was, nevertheless, of benefit to the Industry as a whole. It was, however, not true to say that many engineering firms sent students to day classes. The Board of Education were very interested in this matter, but there were all too few firms who made a practice of doing this. They were hoping that the raising of the school leaving age would encourage them to do so. The Gas Light and Coke Company set an example in the release of apprentices for day classes.

Whether a person should go into the works straight from school and then to College afterwards was a moot point. It was extremely difficult to get a man of 21 who had a Degree to start out on his practical training. Firms would not be bothered with him, and if they would they wanted him to work for nothing. The "sandwich" system was undoubtedly the best. It imposed a considerable strain once having left academic things to have to go back to them.

If their courses were as good as they should be—and they were trying to make them as good as the Institution would allow them—they should not require much personal reading. He would much prefer students to devote their week-ends to their hobbies. They were trying to avoid homework.

It had been suggested that it was strange that teachers of Technical subjects were not trained teachers. The success of places like the Westminster Technical Institute lay in the fact that the teachers were men actually engaged in industry. The full-time teacher rapidly got out of touch with industry. Dr. Long observed that the ancillary subjects were not his idea; they were The Institution of Gas Engineers'. If he did not adopt the Institution Scheme the students would not come to the Institute. The Institution of Gas Engineers was the only body of its kind with a definite Education Scheme. It was impossible to write a text-book on a practical subject, and people could not be taught by reading text-books.

Dr. Long was sorry to hear of the salesmen who could not get beyond the Ordinary Grade; but Salesmanship Courses were not the concern of The Institution of Gas Engineers. It was a very common complaint to find employers unhelpful. Some were enlightened, but many were old-fashioned. In that connexion, The Institution of Gas Engineers, with its considerable levening of practical people, should be able to impress upon undertakings the advantages of such encouragement. They were unable to include economics in the course. In conclusion, Dr. Long said that the discussion had shown a considerable feeling that many things should be put right, and in that respect he was always at their service.

The PRESIDENT stated that the President of The Institution of Gas Engineers had recently addressed members of the Western Junior Gas Association, and had suggested some system of "transfer fees" to cover the situation when trained men left to take up appointments with other undertakings.

The meeting then closed with a cordial expression of thanks to Dr. Long, on the proposition of Mr. HAWES, seconded by Mr. NOBLE, which Dr. LONG briefly acknowledged.

A PLEA FOR

Points from a Symposium

Vitreous Enamel Standards

The Southern Section of the Institute of Vitreous Enamellers held a Symposium at the Charing Cross Hotel, London, on Thursday, November 10, on "Problems of the Users of Vitreous Enamelled Ware." Mr. W. THOMAS presided.

Mr. C. A. MASTERMAN (Gas Light and Coke Company) opened the discussion, and dealt with the problem from the point of view of the Gas Industry. He pointed out that his Company served an area of some 500 square miles, involving a population of about 5 million persons. Vitreous enamelled goods bought for distribution to its consumers probably amounted in value to more than £1,000,000 per annum. Thus, the quality of the vitreous enamel involved, whether on the appliances or fittings attached thereto, was important. The quality must be satisfactory not only when new but must remain satisfactory over a period of years.

The Gas Company could not afford light-heartedly to disclaim responsibility for defect or weakness in the enamel finish of a gas consuming appliance which had been installed for five or more years when attention was drawn to it by the user of gas. Therefore, the Company was repeatedly facing the problem of equating capital cost against cost of subsequent defect or failure; and subsequent defect or failure could be a very expensive business.

In its laboratories the Company had been for long struggling to establish reliable tests which would indicate beyond doubt when the enamel quality was satisfactory for practical purposes over a prolonged period. It had also drawn up a code for acceptance of enamel on visual inspection, attempting, with the co-operation of makers of gas appliances, to give clear indication of the minor blemishes and defects which should not be reasonable causes for rejection, and those more serious though not necessarily more visible blemishes which would be cause for rejection. Finally, it had attempted to ensure that the sales staff should understand that nothing in this world was perfect and that there were blemishes and defects on enamelled finishes which must be accepted as of satisfactory commercial standard and which should not be reasonable cause for return of an appliance by a consumer or for complaint to the manufacturer.

It would be a happy day if there could be established for cast iron and sheet iron goods after enamelling an agreed code for quality, subject to quantitative test in respect of four or five qualities that were desired in respect of finish in a vitreous enamelled article. It would be convenient to have three or four agreed qualities for resistance to acid attack, three or four qualities for resistance to heat, three or four qualities for resistance to mechanical damage, and a variety of qualities for resistance to stains. In that ideal state it would be possible to quote for any given part of a cooker or any other gas appliance or fitting a minimum quality in each category consistent with the requirements of that particular part. Thus, for some parts of a cooker the resistance to mechanical damage would be the only feature of real importance, whereas in other parts the important feature would be resistance to staining or high temperature.

Mr. Masterman drew attention to a code of rules used by the Gas Light and Coke Company for the acceptance or rejection of vitreous enamel finishes on cast iron, from the visual point of view only.

Finally, he expressed the thanks of the Gas Industry to vitreous enamelling experts who had enabled the technique to proceed so fast over the last few years and who had been responsible for the greatly improved appearance and practicability of gas appliances of to-day as compared with those of a few years ago.

Need for National Code.

Mr. S. F. DUNKLEY (Gas Light and Coke Company), commenting on the Gas Light and Coke Company's code of rules for acceptance or rejection of enamel, for which he had been very largely responsible, emphasized the need for some national code of rules or specifications which would put a maximum or a limit to minor imperfections which must of necessity arise in commercial enamelled articles, and he asked whether there was any movement in the direction of producing such a national standard. Some tests were necessary, if only from one point of view of differentiating between good and less good enamels and of providing a basis upon which to work to produce maybe a still better quality of enamel in the future.

Mr. W. MAVOR, who commented that the suppliers of frits had spent a good deal of money on research, pointed out that there were various grades of acid-resisting enamels, and it would be of tremendous assistance to suppliers to know the degree of resistance to acids, to chipping, and so on, required by the users. They would like very much to co-operate in establishing a standard or specification for enamels, and the tests they should withstand.

Mr. E. W. B. DUNNING (Gas Light and Coke Company) remarked that in discussing enamelling problems with the frit manufacturers and the suppliers of appliances there seemed to be some discrepancies. A frit manufacturer might produce wonderful samples and say that a particular enamel was really beautiful, whereas the manufacturer of the appliances would say that he was getting many rejects when applying that particular enamel. Then the frit manufacturer would say that the enameller did not apply it in the right way. The users of the appliances would like those two manufacturers to come to a conclusion as to which was right.

Mr. DUNKLEY said that although he was supposed to be at the bottom of the Gas Light and Coke Company's code of rules for acceptance or rejection of vitreous enamel finishes on cast iron, it had been prepared more or less by some 30 vitreous enamel firms in this country. It would be a good thing to re-circularize the code among vitreous enamel experts, and ask them to modify it. It might represent the start of a national code.

Thickness of Application.

Mr. DUNNING asked if there were statistics to show the relation between the number of defective articles returned and the thickness of the enamel applied.

Mr. B. B. KENT said that 99% of the articles returned by reason of chipping had chipped because the thickness of the enamel was too great.

Mr. DUNNING asked the extent to which the thickness was too great.

Mr. KENT replied that some of the articles had three times the amount of enamel they should have.

Mr. W. E. BENTON (Cannon Iron Foundries) commented that the meeting provided a good opportunity to raise the question of the mis-use of enamel. Every material had its proper sphere of application, and he suggested that when Mr. Dunkley revised his code of acceptance he might give some guidance as to the articles which should never be enamelled at all. Vitreous enamel had a definite sphere of usefulness in connexion with domestic appliances; but they should not lose sight of the fact that it was not an ideal material, and that as soon as there was a better material to take its place, the whole vitreous enamelling industry would go into a decline. Surely the best way to create confidence in vitreous enamelling was to avoid enamelling things which were not suitable for enamelling.

Some companies had asked for enamelled gates, &c., but his own firm had considered it bad practice to supply them. It would be a good thing to have the guidance of some authoritative body as to the things which were not within the province of vitreous enamellers.

Discussing the composition of enamel, he said that the standard of acid resistance necessary to withstand the products of combustion from ordinary coal gas was very high indeed. One could say that it should be able to withstand the action of 10% oxalic acid for half an hour; it would then withstand the action of the products of combustion. His experience was that the effect upon oven linings depended very much upon the amount of sulphur in the gas; some gas undertakings supplied gas in which the sulphur content was admittedly very high, and more trouble arose in the areas supplied by those undertakings than in any others. He was still looking for the person who introduced the enamelled grill pan. Surely a grill pan was totally unsuitable for enamelling, and an enamelled grill pan could not bring the Industry into credit with the public at all.

The CHAIRMAN said that the Institute of Vitreous Enamellers had appointed a research officer, who would work out some standards for discussion. The advantage of that work would arise at some time in the future.

Mr. MASTERMAN, responding to a vote of thanks for having opened the discussion, said that if the meeting resulted in helping forward the establishment of standards, he and his colleagues would have been more than repaid for any effort they had made

YORKSHIRE JUNIOR GAS ASSOCIATION

THE PRESIDENT.

Presidential Address

OF

A. WYLIE

At a Meeting of the Association held at Sheffield on Saturday, Nov. 12.

Mr. A. Wylie commenced in the service of the Glasgow Corporation Gas Department in 1905 and graduated through the various sections of distribution, attaining the confidential position of Chief Administrative Clerk in 1918. He secured his present appointment as Sales and Fittings Superintendent of the Sheffield Gas Company in 1923. Mr. Wylie holds the Glasgow Royal Technical College Certificates for Gas Distribution and Supply. Since 1923 he has been a member of the Yorkshire Junior Gas Association, having served on the Council and also as representative on the District Education Committee for the Yorkshire area for the past nine years. For the past six years Mr. Wylie has also acted as Examiner in Gasfitting in connexion with the Evening Classes held under the auspices of the Sheffield Education Authorities.

Despite honest endeavour on the part of most people in the service of our Industry, it has been a matter of surprise to find that there is still a section of the public prejudiced against extending the use of gas, and this is undoubtedly due to the want of intimate knowledge of its correct application or, perhaps, to previous experience of service received in a haphazard or disorganized manner.

There are many persons who consider gas to be completely out-of-date and very old-fashioned. It is part of our mission to show them where they are wrong and to prove that, as the fifth largest national industry, we are really progressive and move with the times.

In an undertaking such as I have the honour to serve, our policy for many years has been to "standardize service"—no matter how great the problem or how small the complaint, there has been an honest endeavour to give equal service to all classes of the community.

Progress in Sales.

I have no hesitation in saying that we have to a large degree attained that confidence so necessary between the consumer and the Gas Industry, and the result is reflected in the following figures which I place before you.

Since the year 1923, apart from sales by private traders in our area, we have supplied and fixed on the district over 82,000 gas cookers, 30,000 gas fires, and 10,000 gas water heaters. In 1923 domestic sales reached £18,193, and this has risen to £61,527 in 1937.

During the same period we have increased the number of showrooms for the use of the public from one to eleven.

On the industrial side since 1930 we have installed new furnaces and accessories to the value of over £50,000, and this does not cover the cost of conversions done by our Company, neither does it include the value of equipment supplied direct by makers to some of the large industrial establishments. On a fair estimate we can safely mention that the money value of these appliances far exceeds the aforementioned amount.

In Sheffield and most industrial areas there is undoubtedly a tendency for gas to displace competitive fuel for all types of heating operations. The industrial load is of the utmost importance to the Sheffield and District Gas Company, and no effort is spared to cultivate it. Fuel in some form or another is indispensable to the Sheffield industries and, as there are more than 4,500 gas-fired furnaces in use throughout the year, one must appreciate the enormous part gas plays in the fabrication of steel.

Preference in the use of gas during the past years was not due entirely to a sudden realization of its value, nor was it to any marked prosperity of the Sheffield industries as a whole. The important position the Sheffield and District Gas Company now occupies in supplying gas to the steel industries involved the breaking down of strong opposition on the part of works engineers and fuel technologists, and also to the many prejudices set up by the advocates of solid fuel-fired furnaces.

Success was partly due to the enormous improvement in the modern gas-fired furnace itself, and to the scientific method in the application of gas to the many and ever-increasing heating operations necessary in the manufacture of new and improved steels. The special steels available today make for greater demands on the skill of the operator, requiring an accuracy in heat treatment only possible with the right type of fuel and furnace. Closely related, apart from costs which permit profitable sales in a keen competitive market, are rapid output, greater reliability of rate of output, and ability to conform to rigid specifications with the many different types of steels. These and many more have rapidly advanced the claims of gas.

Furthermore, the anxiety of spoiling through overheating intricate and precision tools is completely removed, as a gas-fired furnace is under complete control and can be regulated to give repeat results. This advantage is impossible when working with solid fuel furnaces.

Conversions from Solid Fuel to Gas.

Much progress in the form of conversions and replacements has recently been made in the heavy industries, and repeat installations have shown that industry in general is gradually becoming gas-minded. Recent conversions of solid fuel-fired furnaces to town gas firing in the rolling mill of a large Sheffield works has completely eliminated their smoke nuisance. Prior to gas firing the atmosphere from five large re-heating furnaces was everlastingly impregnated with soot smuts, and when firing it was practically impossible to see from one end of the workshop to the other. As an experiment, one of these large solid fuel-fired furnaces was converted to town gas, principally with a view to ascertaining comparative fuel costs.

A suitable design was submitted with the minimum of alteration to working the furnace, as one of the greatest prejudices to overcome is the changing of present methods of operation. Exhaustive tests were carried out and the results found highly favourable from both gas consumption and output viewpoints. The remaining four furnaces were then converted, and the estimated gas consumption of these

five furnaces when working at a temperature of 1,250° C. and at full capacity was approximately 20,000 cu.ft. per hr.

In the works of another firm a large twin-chamber furnace for ingot heating for sheet rolling was re-designed for temperatures up to 1,200° C., with an estimated gas consumption of 3,000 cu.ft. per hr. So successful were the results that the management decided to install two additional gas-fired furnaces, giving a further 3,000 cu.ft. per hr. for similar work, and now two additional furnaces are under consideration. In every case these furnaces displaced solid fuel and are in operation practically day and night.

In the light steel industries gas-fired furnaces in use are relatively small in size and are principally in operation in the cutlery and allied trades, forging and hardening files, and for the heat treatment of special alloy steels in the form of tools, drills, saws, &c. During the past few years many small furnaces of various types suitable to meet the requirements of these industries have been installed, and although the furnaces are generally simple in design they have proved to be economical and reliable in output.

A recent installation of ten small furnaces for heating blanks for forging, giving an estimated total gas consumption of 3,000 cu.ft. per hr., were successful not only in giving increased production but in the uniformity of the article heated, owing to the easy control of temperatures.

There is practically no firm of any importance to-day in the Sheffield steel industry which does not use gas, either completely or in part, for its heat treatment processes.

Our Competitors.

Like many other undertakings, we are constantly faced with intensive competition—in the domestic field with electricity and in the industrial field with producer gas, oil, and electricity. These competitors have to be considered; their forces are well organized, their sales staffs are experts, their general policy is progressive and thoroughly practical in many instances. There is only one method to adopt in combating such opponents—to have confidence in our own product and be prepared to prove that gas, correctly applied and offered at a reasonable price, can do the work as the manufacturer wishes it to be done.

Like many other industrial cities, Sheffield and district suffer from atmospheric pollution and, while the domestic chimney still remains the chief contributor, the increased use of gas for industrial and power purposes is gradually lessening the evil.

Encouraging Domestic Lighting.

With regard to the artisan classes, to which over 90% of the population in Sheffield may be allotted, we have encouraged the use of gas domestically by offering the free installation of prepayment meters and fittings, and the terms governing these may be of interest.

PREPAYMENT METERS.

Conditions of Supply.

Service.—Laid free up to 30 ft.

Meter.—Free.

Carcassing.—Where no pipes are installed four lighting points (either pendant or brackets) with burners, mantles, and globes, ring burner and cooker point installed free of charge.

Where more than the above is required the extra points will be charged at cost. Extra points 5s. with piping; 3s. 6d. to existing gas point.

Fittings.—Where the piping has been installed by the Company four lighting fittings—*i.e.*, pendants or brackets—will be supplied with inverted burners, mantles and globes complete, together with one gas ring burner with flexible tube complete.

Where the piping is already in, the number of fittings supplied may be increased to six.

Oven Squares.—Free—if installed at time of meter installation. Afterwards 7s. 6d.

Cooking Point Only.—Prepayment meter to be installed if ring or cooker is used only.

Apart from the convenience of this arrangement, you will note the great opportunity it afforded my Company not only of modernizing the lighting fittings in use, but of re-carcassing property with adequate and good quality piping.

Since 1923 60,000 meters, including the installation of new piping, lighting burners and pendants, boiling rings, cookers or gas oven squares, have been completed.

Large Scale Catering.

This is a modern development which requires special mention. Apart from the general catering trades, hotels, restaurants, &c., public authorities, educational establishments, and now industrialists are becoming more gas-minded. Several works canteens are self-supporting and run by the employees themselves. A few particulars regarding these may be of interest.

The Transport Department of the Sheffield Corporation have a canteen situated in the centre of the city, where between 15,000 to 20,000 meals are prepared weekly. The installation includes 4 gas appliances for instantaneous hot water, 5 B.T.U. circulators, and 4 large double cookers. Gas is used exclusively for all cooking and hot water operations. The consumption during 1937 was almost 4,000,000 cu.ft.

In the various schools and educational establishments gas also plays a major part, not only in the preparation of food for the scholars, but in the heating of teachers' rooms, and also laboratory equipment. The domestic science centres are equipped with the latest pattern enamelled cookers complete with oven controls and lighters.

The importance of gas in these places is reflected in the annual consumption, which touches almost 25,500,000 cu.ft.

In one of the Secondary Schools just erected the kitchen equipment includes 2 four-deck baking ovens, 1 double oven cooker, 1 double steamer, 1 single steamer, 1 boiler (boiling water only), 3 forty-gallon boilers, 1 fish and chip range, and 2 carving tables and plate-warmers. Eight hundred meals are prepared daily in this school and the consumption last year was almost 1,000,000 cu.ft.

According to a recent survey, catering establishments, hotels, clubs, cinema and theatre cafés, restaurants, hostels, warehouse canteens, and similar places in Sheffield collectively used over 218,000,000 cu.ft. of gas during the year 1937.

With regard to the professional classes, it may be of interest to mention that our relations with them are also satisfactory. In a recent census we found that the medical practitioners in this district are favourably disposed towards gas —96% of them use it in their homes or surgeries.

Importance of Technical and Local Press.

Are we satisfied with service after sales? Do we read our excellent technical journals with the same interest and avidity as football results? Do we encourage and seek to attract the attention and interest of the local Press and support our own British Commercial Gas Association? These are questions we should have constantly before us. Personally I should like to see some of our own technical papers circulated and made available to many persons who are at present denied the privilege. Such a method—call it propaganda if you care—would have far-reaching effects and do excellent work towards fostering a better understanding between the Gas Industry and the people.

Athletic and Social

Wallasey Presentation.

Mr. H. B. Holliday, Gas and Water Engineer to the Wallasey Corporation, at a dinner and concert at the Pier Café, New Brighton, last week handed gold watches to two employees—Mr. Charles Brammah, and Mr. George Graham—on the completion of 25 and 30 years' service respectively at the Corporation Gas-Works. The attendance numbered 110 employees, including eleven who had previously retired at the age of 65 years.

Cardiff Dramatic Section's Success.

The Dramatic Section of the Cardiff Gas Light and Coke Company's Social Club, which was formed recently, gave a public performance of a farce called, "Three Half Crowns." This was the first play they have produced. There were naturally doubts as to how the Society would fare with its first effort, but on the night of the performance even those who had been most optimistic were amazed. The large assembly-hall was packed to capacity, and scores of people failed to gain admission.

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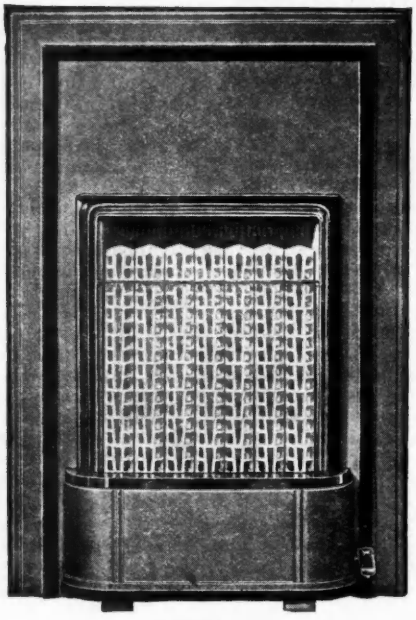

Literature obtainable on request.

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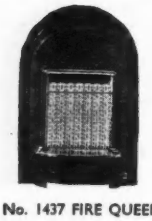

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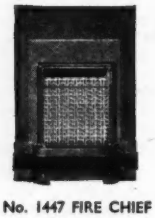

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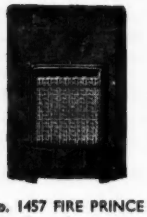
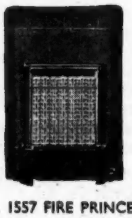


No. 1457 FIRE PRINCE



No. 1557 FIRE PRINCESS

Scottish Junior Gas Association
(Western District)
The Work of the National Bodies in Scotland

Mr. W. R. Drummond, Secretary of the National Gas Organizations in Scotland, addressed the members of the Scottish Junior Gas Association (Western District) on Saturday, Nov. 12.

He explained how his work embraced the National Gas Council, the Federation of Gas Employers, and the British Commercial Gas Association. He dealt briefly with the work of the National Gas Council and explained how it concerned itself with Legal and Parliamentary matters. Scotland was losing a great deal because it had no Industrial Gas Development Centre such as existed in England, but it was hoped that in the near future Scotland would have something similar.

Mr. Drummond then dealt with the Federation of Gas Employers and said that the relationship existing between employer and employee in the Gas Industry had been most harmonious and traced this state of affairs to the fact that a Committee comprising employers and employees' representatives met frequently to discuss matters of wages and conditions of labour.

The speaker then told the meeting of the work of the British Commercial Gas Association and what it was accomplishing in Scotland. Mr. Drummond said that there had been occasions, when erroneous statements appearing in the Press had had to be corrected, which statements had been made by people who had been misinformed or misreported, but whose word appearing in reputable journals might be taken by the layman as representing the mind of authority on the Gas Industry generally. These, however, were few and far between. District Conferences were organized in order that the housewives of the country might learn from trained minds what gas could do in the house and elsewhere. These Conferences attracted the attention of the Press and in this way publicity of the right kind was obtained for gas.

Film shows had been, and were being, held at which audiences representing most types in the community saw what the Gas Industry was doing to make easier the lives of everyone. These films, said Mr. Drummond, were more of an educational value than a propaganda value to gas. He told how at the venues of the Highland Show in Scotland the B.C.G.A. had had stands displaying gas appliances and how these shows had been most successful and profitable. The main topic, at this period, of course, was the Gas Pavilion at the Empire Exhibition where 1,100 enquiries had been booked, together with some 400 at the Industrial Gas Stand in the Palace of Engineering.

Criticism had been levelled at the Gas Pavilion, but it was pleasing to know that this came principally from within the Industry, and that he had been told many times by many people how they had appreciated the "Gas Show." If Mr. Therm was not known in Scotland prior to the Empire Exhibition, he was most certainly a familiar figure now. He would like to know how many of the enquiries made had borne fruit, but he was sure that interest in gas had been enlivened by the Gas Pavilion at Bellahouston.

Mr. Drummond then spoke briefly on the campaigns run by the B.C.G.A. and spoke of Smoke Abatement and its necessity in the improvement of public health.

Concluding his Address, the speaker appealed for support of the B.C.G.A. Salesmen's Circles, as these, he said, would ably fit a salesman to deal more competently with the problems confronting him in his work.

Discussion.

Mr. E. G. SMITH (Dumbarton), in thanking Mr. Drummond, said that Industrial Gas Development Centres were too late in arriving in Scotland and that it would be very helpful to have an Industrial Service upon which undertakings could call. Smoke Abatement was a subject upon which everyone should be informed, and not enough use was made of this when salesmen were selling gas or coke appliances. Mr. Smith spoke of sales training, saying that Seniors should encourage their own staffs to sell better and not depend on the salesman of an appliance manufacturer to sell appliances to consumers. Not enough gas was shown at the Kelvin Hall Exhibition in Glasgow; the B.C.G.A. should encourage manufacturers to display at that Centre in Scotland's foremost domestic Exhibition. Finally, the B.C.G.A. propaganda savoured a little too much of England to appeal to the temperament of the Scottish housewife.

Mr. W. KIRK (Motherwell) said the co-ordination of the National Bodies under one head had greatly assisted undertakings in Scotland, and he thought that it was a happy choice that had put Mr. Drummond at the head of these Bodies. Mr. Kirk said that the harmony existing between employer and employed in the Gas Industry was excellent and all appeared to be very satisfied.

Mr. RAE (Scottish Representative of Electrolux, Ltd.) stated that at the Kelvin Hall Exhibition 150 refrigerators had been sold in 3½ weeks; he considered that should be a sufficient inducement for all manufacturers to show. He agreed with Mr. Smith that Seniors should encourage their Juniors to sell and advocated Sales Circles to fit salesmen for their work.

Mr. J. GREIG (Glasgow) said that when he first visited Bellahouston the Gas Pavilion disappointed him, but succeeding visits helped to convince him that it was a most successful show.

Mr. W. C. STURROCK (Greenock), President of the Association, informed Mr. Drummond that of the enquiries received in Greenock from the Empire Exhibition 75% had led to business. He also thought that the B.C.G.A. menus and recipes were not too suitable for Scottish housewives.

North of England Auxiliary Association
Half-Yearly Meeting at Newcastle

The Thirty-Seventh Half-Yearly Meeting of the Auxiliary Section of the North of England Gas Managers' Association was held at the Gas Offices, Newcastle, on Friday, Nov. 18.

The Chairman, Mr. George Neil, Works Engineer to the Southampton Gaslight and Coke Company, was unable to attend and Mr. G. J. Duncan (South Shields) presided in his absence. He was also elected Chairman for the ensuing year and Mr. F. Nicholls (Newcastle-upon-Tyne) was elected Vice-Chairman, and with Mr. Bernard Richardson (Newcastle) was appointed to the Committee. Mr. W. Oliver Kirkwood (Sunderland) took over the secretarial duties from Mr. L. M. Weldon (West Hartlepool).

A vote of thanks to the retiring officials was expressed by Mr. W. E. Oulds (North Shields) and seconded by Mr. J. B. Henderson (Newcastle).

An Address, with practical illustrations and examples, was given by Mr. J. S. Merry, A.I.C., of Feedwater Specialists Company, on "Boiler Water Problems." This, together with the discussion which followed, will be dealt with in a subsequent issue.

Scottish Juniors Tour Edinburgh
Industrial Applications of Gas

Some 85 members of the Scottish Junior Gas Association (Eastern District) took part in an interesting visit on Nov. 5, when they inspected various works in Edinburgh where gas is used for industrial purposes.

The first call was at the printing works of *The Scotsman*, where the application of gas to the melting of metal in the stereo pots was seen. The gas used at these works for various purposes amounts to over seven million cu.ft. per annum, and includes what is believed to be the oldest metal pot in the printing industry, this having been gas-fired for thirty years.

The fireclay works of Messrs. Steele Bros., at Niddrie, were next inspected. This works uses a gas-fired kiln 422 ft. long which has been converted from producer gas—the conversion having been carried out by the staff of the Edinburgh Gas Department. There are 72 burners throughout the length of this kiln, 40 being in the high-temperature zone. The highest temperature attained is 1,320° C., and the gas is supplied through a Peebles governor set at 3 in. W.G., the consumption being 36 therms an hour.

The members were subsequently entertained at tea by the Corporation—Lord Provost Steele presiding, supported by Councillor Duncan (Convener of the Gas Committee), Mr. J. Jamieson (Engineer and Manager), and Mr. D. Melvin (Assistant Engineer and Manager of the Edinburgh Gas Department). The Lord Provost welcomed the Association, and Councillor Duncan thanked the Lord Provost for presiding and assured the Juniors that his Committee were very pleased to have them in Edinburgh. Mr. Jamieson thanked Councillor Duncan for his presence—this being his first public engagement for some time owing to illness. He spoke of the excellent work the Juniors were doing and said how glad he was to see them in Edinburgh.

The President (Mr. R. Cowie, Junr., of Hawick) voiced the appreciation of the Association for the kindness and hospitality accorded them and referred to the great honour the Lord Provost did them by welcoming them in person. He thanked Mr. Jamieson and his staff for a very interesting afternoon.

After tea the members visited the Ideal Home Exhibition in the Waverley Market, where the Gas Department had a comprehensive exhibit. Later they had the opportunity of seeing the latest gas films in the small theatre adjoining the gas display.

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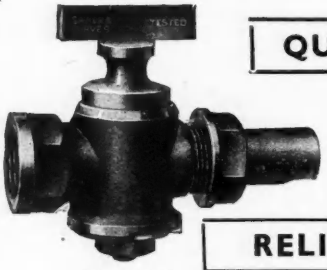

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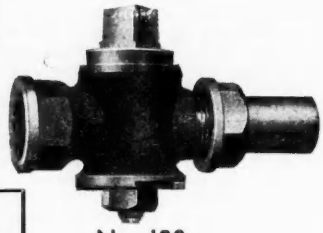

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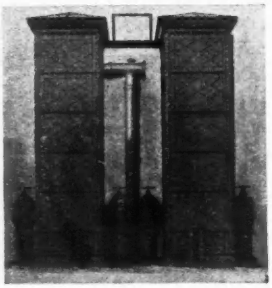

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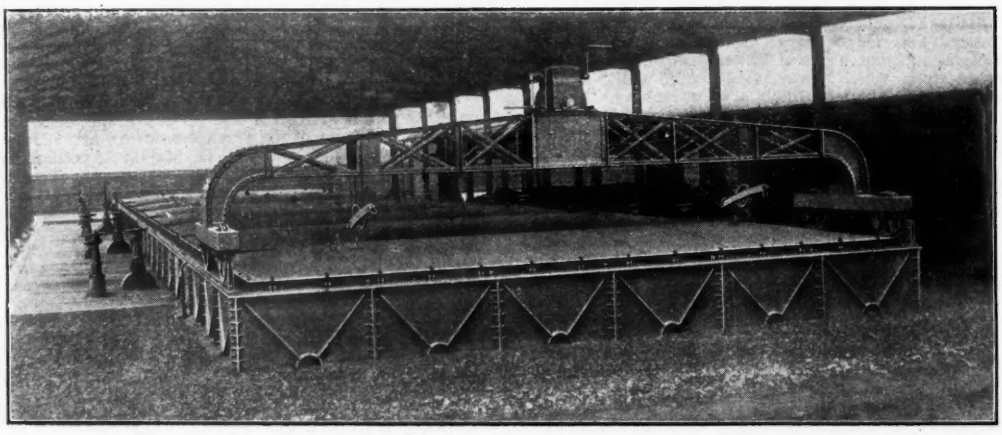

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Institution of Gas Engineers

WRITTEN COMMUNICATIONS.

Continued from p. 638.

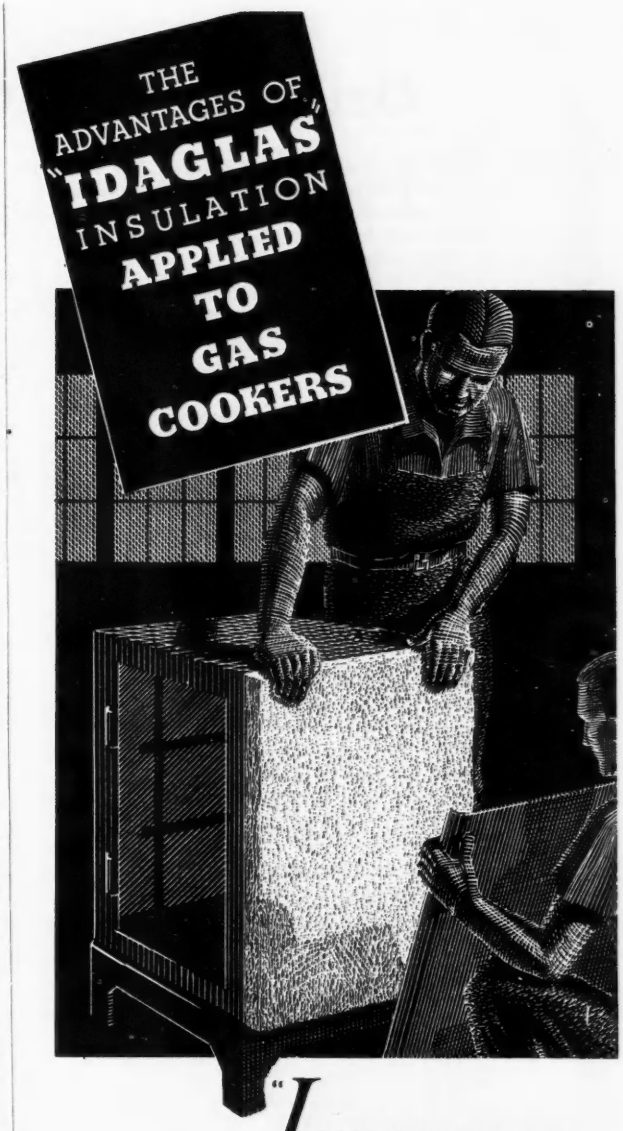
can only be based on accurate data and the researches at the University of Leeds are serving a very useful purpose in providing these data.

There is a minor point in Section VII. The Authors state that an increase in weight of over 1 g. represents a loss of over 5 per cent. of the metal in the case of a specimen weighing 15 g. Without their direct knowledge, I should be inclined to regard this as an under-estimate and should have computed a figure of about 20 per cent., based on the assumption that the oxide contained approximately 75 per cent. of iron. It may be, of course, that in sulphur-containing atmospheres the scale formed is of a different type and contains rather less oxygen. Have the Authors made any analyses of the scales obtained in their recent researches? If not, I think it desirable that they should do so, in order to enable their results, which are at present expressed in terms of the observed increases in weight, to be converted into actual loss of metal.

Professor Cobb's Reply.

Professor J. W. COBB, in reply, wrote: Each contributor to this discussion has emphasized, rightly, I believe, the necessity for carrying out and extending work of this character. Among other things it gives quantitative and clear demonstration of the savings both in fuel and metal which can and ought to be made by the carefully controlled use of the right fuel in well-designed furnaces. It displays the virulence of the attack made by sulphur compounds in the furnace atmosphere and explains why the use of town gas instead of cheaper fuels has been so often found to be a real economy, and is so rapidly increasing. The exactness of control possible with clean pure town gas and its low sulphur content give it a great initial advantage, even although, as suggested by Dr. Stewart, other things being the same, carbon monoxide is intrinsically less scale-producing than hydrogen. A well-controlled coke producer should be excellent in this respect, but, of course, the gas from it is always much higher in sulphur content than town gas.

Mr. Clark's remarks show that the field of enquiry is open for those in charge of works processes, each of which no doubt raises its own questions. The written contribution of Dr. Evans is very much to the point. I should like to thank him specially (i) for calling attention to his explanation, confessedly tentative, of the accelerating action of sulphur compounds on scaling by the transitory formation of sulphate or sulphide followed by decomposition to porous oxide and (ii) for his exposition of why n lies in value between 1 and 2 in the parabolic formula $W^n = kt$. Dr. Hudson quite rightly refers to his previous insistence upon the importance of obtaining such results as are now presented for high-temperature scaling and attack on metals and will be interested to know that the survey is being extended in the Leeds laboratories with the support of the Iron and Steel Institute to alloy steels and that preliminary work has been done on the non-ferrous metals. The application which he makes by calculation from our results to large-scale practice is exactly what we hope will be done more generally. Finally, may be thank him for the "minor point" which he raises as to the waste of metal in a particular instance, given by mistake as 5 per cent. when it should have been about 20 per cent. as he indicates.



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Company Meeting

Oriental Gas Company, Ltd.

The Ordinary General Meeting of the Oriental Gas Company, Ltd., was held at the Company's Office, Finsbury House, Blomfield Street, E.C. 2, on Thursday, Nov. 17, 1938—Mr. B. W. ELLIS, A.M.Inst.C.E. (Chairman of the Company), presiding.

The SECRETARY (Mr. A. W. Hentsch) read the notice convening the meeting, together with the Auditors' Certificate. The Annual Report and Statement of Accounts were taken as read.

THE CHAIRMAN'S ADDRESS.

The CHAIRMAN said: Before we review the accounts and history of the Company for the year ended June 30 last, I will call your attention to the Directors' Report, in which we record an increase in gas sold of 3·83%. This comes on top of increases of 2·47% and 1·68% in the two preceding years, and similarly the increase in the number of appliances fixed is 1,264 against 1,193 and 772 in the two preceding years.

Turning to the accounts, the Capital Account is unchanged. There has been an expenditure of £1,108 which could have been properly charged to Capital, but in accordance with our usual practice this has been debited to Revenue.

In the Revenue Account coal cost more by £1,560, the increase in gas output has, of course, resulted in more coal being carbonized. Salaries are £400 higher by reason of normal increases. Carbonizing Wages are £103 up. Works Repairs and Maintenance are lower by £830 and manufacturing costs are up by £1,214, as might be expected with the increase of output. Distribution Salaries are up by £150 and Repairs to Mains and Services by £430. Expenditure on Meters is lower by £200, but Fittings cost more by £870, occasioned by the increase in the numbers of cookers and refrigerators on the district. Total Distribution costs are £1,270 higher. Public Lamp Maintenance is more by £230 owing to increase in costs of labour and material. Rents, Rates, and Taxes show an increase of £1,280 owing to higher assessment and payment of National Defence Contribution; further, Rents are slightly increased and will be still more in the current year, as we have opened central offices over our showroom, to which I will refer later.

Management expenses are lower by £760, due chiefly to revision of London Salaries consequent on the death of our late Secretary. Bad Debts are £50 lower; Law Charges, £23 higher; Superannuations are up £294—further Staff pensions having been granted. Gratuities to members of the Indian Staff on leaving are up £70. There has been a slight decrease in both Passages and Insurance.

Increased Gas Consumption.

Now to turn to the credit side of the Revenue Account, the consumption has been increased by over 23 million cu.ft. and the revenue by £3,900, Meter and Cooker Rental, which covers domestic appliances, is up by £1,600, over three-quarters of this increase being due to the extended use of refrigerators.

Residuals are up by £4,160. As I said a year ago, the coke market was showing an improvement which should extend over the following year. This has been maintained, the price having risen about 30%. Even now this price—some 12s. per ton—is a miserable figure compared with prices in this country. We have sold more tar, but at the same price.

Total receipts are £9,654 and expenditure £3,340 higher, resulting in an increase in trading profit of £6,313.

In the Net Revenue Account bank interest is slightly lower, interest on investments is up by £200 owing to the purchase of Funding Loan 18 months ago. Exchange profit shows an increase of £927—larger remittances having been received than in the previous year. In conclusion, the sum carried forward is higher by £19,289.

Now with regard to the balance-sheet, the amount due by the Company is lower by £1,384. Those of you who attended last year will recollect that I accounted for the rise of £1,814 in this item by the necessity which our Manager then felt for buying material ahead of immediate requirements. We are now nearer the usual figure in this respect. Assets are £17,900 higher represented by increases in cash, stocks and amounts due to the Company. I may say that the present Stock Exchange value of our Investments, though lower than on June 30 last, is still substantially higher than the figure in the balance-sheet.

During the year 1937-38 the quality and purity of the gas has been maintained. Our Manager reports that our works and plant have been well maintained. There has been no great extension of main-laying in the year now under review, but in order to cope with the increasing demand for gas your Directors have under consideration a comprehensive scheme for the improvement of our distribution system, which, when completed, will, it is anticipated, meet our consumers' demands for some time.

Public Lighting.

Regarding our public lighting, our Manager is making every effort to obtain, on the expiration of the current public lighting contract, the maintenance of the gas lamps with a view to greatly improving the gas lighting of the city. As I said last year, we are ready and willing to co-operate with the Municipality to make the lighting of Calcutta worthy of the second City of the Empire.

Although there has been no serious epidemic in Calcutta yet our staff have suffered more, perhaps, this year than for some time past, and this I will enlarge on in a later tribute to their service.

In April last we transferred our offices from the works to the centre of the town, where we have secured, on favourable terms, a lease of the premises over our showrooms. Our Indian headquarters now being situated in the City, will enable our administrative staff to be in closer touch with the commercial community and facilitate our efforts to give service to our consumers generally.

I have already referred to the satisfactory increase in the sale of gas which has been been aided by the increased numbers of cookers, refrigerators, and geysers which have been fixed on the District. Refrigerators are proving very popular.

And now before moving the adoption of the Report and Accounts I shall be glad to reply to any questions arising from them.

There being no questions, the CHAIRMAN moved: "That the Report of the Directors and Statement of Accounts now submitted be received and adopted."

The resolution was seconded by Mr. STANLEY H. JONES and unanimously carried.

The CHAIRMAN then proposed that a Final Dividend of 4½%, free of income-tax, be declared, making 8%, free of income-tax, for the year ended June 30, 1938. In moving this resolution, the Chairman observed that the Directors had considered the question of paying the dividend free of income-tax or subject to income-tax. They had paid the interim dividend free of tax, and they had decided to pay this final dividend free of tax also. He must, however, warn the proprietors that in view of the uncertainty of the calls which might have to be made on the Company in the future, it might not be able to continue so doing.

Mr. H. H. MACLEOD seconded the proposition, which was unanimously agreed.

The CHAIRMAN thereafter moved the re-election to the board of Mr. Stanley H. Jones, being the Director retiring by rotation. They all knew Mr. Jones so well that it was unnecessary for him to say anything in support of this resolution.

Mr. B. M. GILL seconded, and the resolution was carried unanimously, Mr. JONES briefly returning thanks.

On the proposition of Mr. R. H. W. ELLIS, seconded by Mr. E. COWEE, the Company's Auditors (Messrs. S. W. Savage and F. J. Bradfield) were re-appointed, Mr. BRADFIELD acknowledging this renewal of their confidence.

Votes of Thanks.

The CHAIRMAN said he had pleasure in proposing a vote of thanks to their staff abroad and at home, and he did not recall any year when they had more deserved this. Mr. Savage, who had been the General Manager for three years, had given them a progressive increase of gas sales over that period. This, for a Company in business for over eighty years was no mean achievement and compared with the larger percentage increase of their junior rival. Mr. Savage had had to do more work during the year with less assistance. This was due to the industrial unrest which cropped up, stimulated by malicious outside influence and also the protection of the reputation of public gas supply against the attack levelled at it. He was very sensible of Mr. Lyle's help, who had become a member of the Municipality and was an invaluable assistant. Mr. Pope, their Meter and Fittings Superintendent, had been on leave and now was returning much benefited. His new assistant, Mr. Weldon, had been in Calcutta some months and was shaping well. Mr. Atkinson, their Accountant, was also now home on leave. Mr. Smith, their Works Superintendent, had been in bad health for some months and only able to attend at intervals. He had served the Company for 28 years and was returning about March, when they would lose him with regret. Mr. Monson was on the way to take over from him after

an overlapping period to allow him to acquire some of Mr. Smith's experience. Mr. Bathgate had, in addition to his work as Mains Superintendent, taken over Mr. Pope's work to a large extent. And, finally, Mr. Gladstone, whose services they shared with the Bombay Company, had done great service during Mr. Savage's leave last year, particularly as regards the industrial trouble. He had, in common with all their people, given generous assistance to their interests when on leave. Here he would say that if they thought he was, compared with other Companies, somewhat expansive in this vote to the staff, he could only reply that he had lived in Calcutta under somewhat similar conditions to them and that the Board took a strong personal interest in their conditions of life. He expressed to the London Staff also their sensibility of their excellent service during the year. Mr. Hentsch had completed his first entire year in his new post and had amply justified their expectations, having been watchful for any chance of furthering the proprietors' interests. During his holiday, which was encroached upon, Miss Barron took charge and handled the secretarial work to their entire satisfaction. To them and their staff in Calcutta he asked the proprietors to accord a sincere vote of thanks.

The vote of thanks was seconded by Mr. B. M. GILL.

Supporting the vote, Mr. R. GLEN said he happened to be in Calcutta not long ago and was kindly granted permission to visit the works. He was usually able to obtain useful information at the works, and this was no exception. The general impression on seeing their works was that they were very good indeed. He also visited the new showrooms, and it was an admirable move to have the offices above them, because they could not expect business people to go to the works. But even with efficient works they could not get good results without a good staff—and the latter they certainly had.

The CHAIRMAN said that Mr Glen's remarks were very welcome; it was a great pleasure to hear his confirmation of their own belief in the excellence of their staff. The Directors had to undertake the ultimate responsibility and make decisions, but it was the staff who did the work and earned the money.

The vote of thanks was carried unanimously, and was briefly acknowledged on behalf of himself and his colleagues both at home and abroad by Mr. HENTSCH.

The meeting terminated with an expression of thanks to the Chairman and Directors on the motion of Mr. H. T. BARNETT, seconded by Mr. E. COWEE, which the CHAIRMAN duly acknowledged.

Trade News

Property Supply Company, Ltd.

Dr. F. M. H. Taylor, who has recently resigned his position with the Gas Light and Coke Company, is now Chairman of the Board of Directors of the above Company, whose address is 6-9, Charterhouse Square, E.C. 1. The Company deal with the engineering and domestic services to restaurants, blocks of flats, and to the tenants controlled by a group of property companies in the London and Home Counties area.

Thermocontrol Installations.

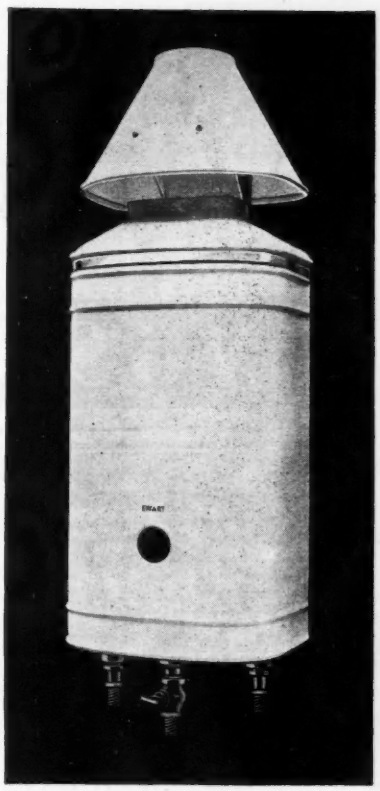
The rapid development in the use of gas for central heating, central hot water, and other purposes where a gas boiler is involved, has lead to considerable attention being focused on the necessity of providing adequate and proper controls.

Thermocontrol Installations Company, Ltd., 68, Victoria Street, was founded some four years ago to specialize in the provision and installation of all forms of control for both gas and coke boilers. Mr. R. W. Lowman, Gas Sales Manager of the Gas Light and Coke Company, has recently been appointed to the Board as a nominee of the Gas Light and Coke Company, and Dr. F. M. H. Taylor, until recently the Gas Light and Coke Company nominee, now becomes Managing Director.

The Company has made considerable progress during the year. A number of leading architects, consulting engineers, and public authorities have specified T.I.C. control installations either for gas or coke boiler plants for general heating and air conditioning work. The heating trade recognizes the value of one firm taking the whole responsibility for a control installation rather than dividing the work, as hitherto, between control manufacturer, local electrical contractor for installation, and the main heating contractor for adjustment.

The Company has co-operated with such bodies as the War Office and the Metropolitan Police in preparing specifications for gas boiler plant and general heating controls for large installations. A special feature is made of safety controls for gas boilers. Full protection is afforded against pilot flame failure and damage to steam boilers through loss of water level.

THE
EWART
'EMPIRE'
GAS WATER HEATER



Designed for easy installation and maintenance . . . provides abundant hot water to all taps.

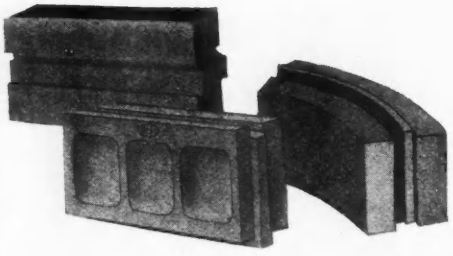
EWART & SON LTD
346-350 EUSTON ROAD LONDON N.W.1
'PHONE:—Euston 4488 'GRAMS:— Geyser London

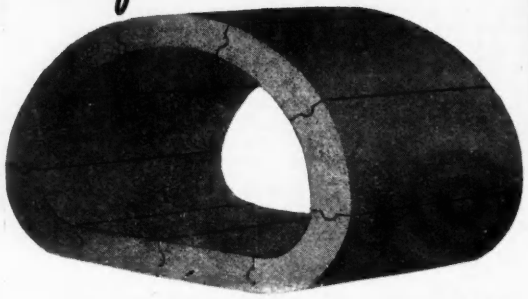
333

REFRACTORIES

For the Gas Industry

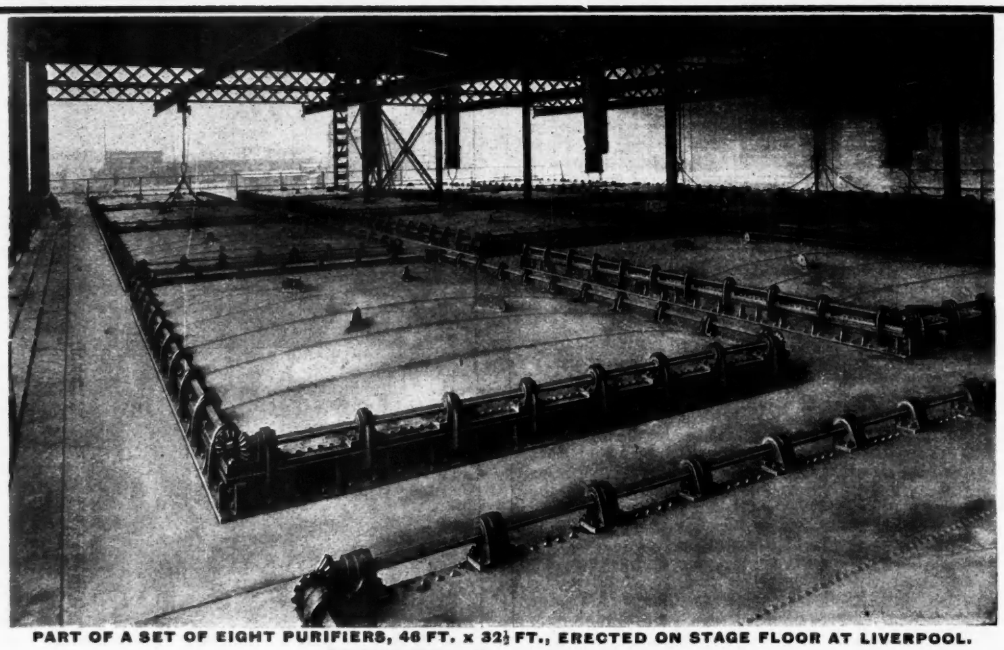
Retort sections and special shapes for horizontal and vertical installations can be relied upon to give trouble-free and economic service when made in "BLUEBELL" 95% Silica material.





For producer linings, water-gas fillings, etc., "THISTLE" (35/37% alumina) and "STEIN" (30/32% alumina) firebricks are admirably suited by reason of their excellent high temperature properties.

JOHN G. STEIN & Co LTD BONNYBRIDGE SCOTLAND



PART OF A SET OF EIGHT PURIFIERS, 46 FT. x 32½ FT., ERECTED ON STAGE FLOOR AT LIVERPOOL.

COMPLETE PURIFIER INSTALLATIONS
WITH BOXES IN C.I. OR STEEL

C. & W. WALKER, LTD., DONNINGTON, Near WELLINGTON—SHROPSHIRE.

'Phone: Lilleshall-Shropshire Nos. 34 & 35 (2 lines) 'Grams: "Fortress," Donnington, Shropshire
'Phone: Victoria No. 1941 LONDON OFFICE: 70, VICTORIA STREET, WESTMINSTER, S.W.1. 'Grams: "Fortress," Soweast, London

Markets and Manufactures

Current Sales of Gas Products

The London Market

LONDON, *Nov.* 21.

Values of Tar Products generally in the London market are unaltered, current prices being as follows:

Pitch nominal at about 31s. per ton f.o.b.
Creosote, 4d. to 4¼d.
Refined tar, 3¾d.
Pure toluole, about 2s. 3d.
Pure benzole, about 1s. 9d.
99/160 solvent naphtha, 1s. 7d. to 1s. 8d.
90/160 pyridine, 10s.
All per gallon naked at makers' works.

The Provinces

Nov. 21.

Crude Gas-Works Tar, 15s. to 20s.

To avoid misunderstanding, it is necessary to state that the above price is not claimed to represent a market value. It is a price worked out from week to week upon a system which has been used for many years as a basis for the fixing of certain contracts for crude tar of varying qualities in different areas.

The average prices of gas-works products during the week were: Pitch—East Coast, 31s. to 32s. f.o.b. West Coast—Manchester, Liverpool, Clyde, 31s. to 32s.* Toluole, naked, North 1s. 7½d. to 1s. 9d. Coal tar, crude naphtha, in bulk, North, 7¾d. to 8¼d. Solvent naphtha, naked, North, 1s. 4½d. to 1s. 5d. Heavy naphtha, North, 1s. 2½d. to 1s. 3d. Creosote, *ex* works, in bulk, North, liquid and salty, 4⅜d. to 4⅝d.; low gravity, 4¼d. to 4¾d. Carbolic acid, 60's, 1s. 7d. to 1s. 10d. Naphthalene, £13 10s. to £16. Salts, 70s. to 75s., bags included. Anthracene, "A" quality, 4½d. to 4¾d. per minimum 40% purely nominal; "B" quality unsalable. Heavy oil: Unfiltered anthracene oil, min. gr. 1,080, 4¾d. to 4⅞d.; filtered anthracene oil, min. gr. 1,080 5¼d. to 5¾d.; heavy tar oil, gr. less than 1,080, 4¼d. to 4¾d.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Scotland

GLASGOW, *Nov.* 19.

While inquiries are quite plentiful, actual business is difficult and quotations remain easy.

Crude gas-works tar.—Actual value is about 37s. to 38s. per ton *ex* works in bulk.

Pitch is still quiet with value called about 22s. 6d. to 23s. 6d. per ton f.o.b. for export, and about 20s. to 22s. per ton in bulk for home trade.

Refined tar.—The home price is unaltered at 3¾d. to 4d. per gallon, while, for export, quotations are easy at round 3d. per gallon, both into buyers' packages at makers' works.

Creosote oil.—Business is now being considered for delivery into next year at the following prices: Specification oil, 4¼d. to 4⅜d. per gallon; low gravity, 4¾d. to 5d. per gallon; neutral oil, 4¼d. to 4½d. per gallon; all *ex* works in bulk.

Cresylic acid.—In the absence of business of any consequence prices are more or less nominal as under: Pale, 97/99%, 1s. 2d. to 1s. 4d. per gallon; dark, 97/99%, 1s. to 1s. 2d. per gallon; and pale, 99/100%, 1s. 4d. to 1s. 8d. per gallon; all according to quality, *ex* works in buyers' packages.

Crude naphtha is fairly steady at 5½d. to 6d. per gallon *ex* works in bulk, according to quality.

Solvent naphtha.—90/160 grade is 1s. 3½d. to 1s. 4d. per gallon and 90/190 heavy naphtha is round 1s. 1d. to 1s. 1½d. per gallon.

Motor benzole is 1s. 3d. to 1s. 4d. per gallon.

Pyridine.—90/160 grade is 8s. to 9s. per gallon and 90/140 grade is 9s. to 10s. per gallon.

Benzole Prices

These are considered to be the market prices for benzole at the present time:

	s.	d.		s.	d.	
Crude benzole ..	0	9⅛	to	0	10	per gall. at works
Motor „ ..	1	3	„	1	3⅛	„ „ „
90% „ ..	1	4	„	1	4½	„ „ „
Pure „ ..	1	8	„	1	8½	„ „ „

Contracts Advertised To-Day

Coal.

Iron Bridge and District Gas Company. [p. 662.]

Gas Oil.

Bexhill Gas Department. [p. 662.]

Pipes, Specials, and Fittings.

Atherton Gas and Water Department. [p. 662.]
Dewsbury Gas Department. [p. 662.]
Rochdale Gas Department. [p. 662.]

Purifier Conversion.

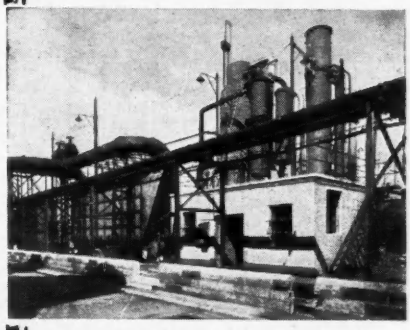
Glasgow Gas Department. [p. 662.]

New Capital Issues

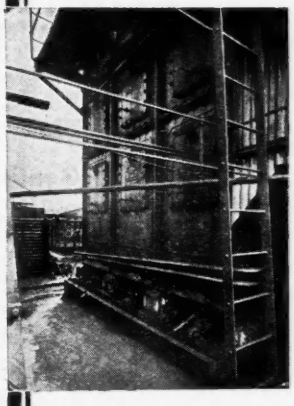
Romford 4% Pref.—Lists opened on Nov. 15 for an issue by the Romford Gas Company of £100,000 4% redeemable preference stock, 1963, at par, to rank *pari passu* with the existing preference stocks. The Company supplies an area of about 43 square miles. During the past six years the Company's sales of gas have increased substantially on the quantity sold in the year 1931, being equivalent to an average annual increase of over 9%. For the years 1935-37 a dividend of 8% was paid on the ordinary stock of the Company.

Rugby Issue Over-subscribed.—The issue of £26,000 of 4½% preference stock at par by the Rugby Gas Company was considerably over-subscribed. Tenders ranged from the minimum up to 110%. The lowest tender to receive an allotment was £100 2s. 9d.%.

Every Joint Sound!



"Permac" Joints in a Gas Works.



"Permac" Joints in a Gas Works.

Ever since 1913 "PERMAC," the original Metal-to-Metal Jointing, has been holding up difficult joints like these in important Gas Works and on Coke Oven Plants all over the world. Equally suitable for any joint—steam, water, gas, oil — screw pipe or flange.

Send for particulars

Permac
METAL-TO-METAL JOINTING MATERIAL

Sole manufacturers:—

THOMAS & BISHOP LTD.
37, Tabernacle St.
LONDON, E.C. 2
Telephone: Clerkenwell 3351 (2 lines)

REPEAT ORDERS

ARE NOW IN HAND FOR EXTENSIONS TO GLOVER - WEST VERTICAL RETORTS FOR THE FOLLOWING UNDERTAKINGS

- **Bedford**
- **Bergen**
- **Blackpool**
- **Coatbridge**
- **Coventry**
- **Dublin**
- **Hull (East)**
- **Leeds**
- **Le Mans**
- **Motherwell**
- **Oldbury**
- **Perth**
- **Romford**
- **Slough**
- **Sydney**

GLOVER-WEST VERTICAL RETORTS

. . . for coal carbonization with the advantages of modern scientific control

WEST'S GAS IMPROVEMENT CO. LTD.,

MANCHESTER: Albion Ironworks, Miles Platting ■ LONDON: Columbia House, Aldwych, W.C. 2

GAS STOCKS AND SHARES

The tone of stock markets at the opening last week was in marked contrast with that of the previous period. The volume of business fell away and prices in nearly all departments lost ground. The chief cause of the uneasiness was the fear that Germany's latest attack on the Jews would have a deleterious effect on Mr. Chamberlain's peace policy. Later in the week, however, affairs took a turn for the better, and a stimulus was provided by the Anglo-U.S. Trade Agreement, though this came too late for prices to recover fully all their previous losses.

On the week, British Funds closed fractionally lower and home rails were also weaker, some losing rather heavily. Industrials were patchy and a few favourites lost ground. Several mining shares improved, but on the whole the market was dull. The oil and rubber sections were quiet and uninteresting.

The Gas market was comparatively well supported throughout the week, and of the few price changes the majority were in an upward direction. In the Official List Gas Light units made a further small advance, closing 3d. higher at 22s. 9d., and it will be seen that most of the other movements occurred among fixed-interest stocks. Except for a rise of 1 point in Liverpool ordinary, prices on the Provincial Exchanges remained unchanged.

The Directors of the Severn Valley Gas Corporation have made an offer to acquire the whole of the issued ordinary stock of the Shrewsbury Gas Company The offer consists of either 130 £1 ordinary shares of the Corporation, credited as fully paid, together with £2 in cash, or £147 in cash, for each £100 ordinary stock of the Shrewsbury Company. Since the last dividend on the Shrewsbury stock was £6 15s.% and, on the basis of the previous rate, the return on the Corporation shares offered is £7 3s.%, the terms appear very favourable; the shares issued in exchange will rank for dividend from Jan. 1, 1939. The quotation of the Shrewsbury stock was marked up 16 points to 143-148 when the offer became known.

Official Quotations on the London Stock Exchange

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Nov. 18.	Rise or Fall on Week.
1,767,439	Sept. 5	8	8	Alliance & Dublin Ord. ...	130—140	...
374,000	June 20	4	4	Do. 4 p.c. Deb. ...	95—100	...
734,733	Nov. 7	5	5	Asscd. Gas & Water U'd'ts Ord.	17/-—19/-*	...
500,000	,,	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	19/—21/-*	...
444,389	,,	4	4	Do. 4 p.c. Red. Cum. Pref.	19/—21/-*	...
296,523	,,	4	4	Do. 4 p.c. Irred. Cum. Pref.	16/—18/-*	...
500,000	Sept. 5	3½	3½	Do. 3½ p.c. Red. Deb. ...	93—98	...
560,070	Aug. 22	7	7	Barnet Ord. 7 p.c.	157—162	...
300,000	Oct. 10	1/9⅜	1/4⅜	Bombay, Ltd.	24/-—26/-	...
180,435	Aug. 22	9½	9½	Bournemouth sliding scale ...	195—205	...
640,407	,,	7	7	Do. 7 p.c. max. ...	157—162	+2½
495,960	,,	6	6	Do. 6 p.c. Pref. ...	130—135	...
50,000	June 20	3	3	Do. 3 p.c. Deb. ...	75—80	...
312,025	,,	4	4	Do. 4 p.c. Deb. ...	97—102	...
335,000	,,	5	5	Do. 5 p.c. Deb. ...	115—120	...
357,900	Aug. 8	7½	7½	Brighton, &c., 6 p.c. Con. ...	142—147	...
659,955	,,	6½	6½	Do. 5 p.c. Con. ...	126—131	...
205,500	,,	6	6	Do. 6 p.c. 'B' Pref.	120—125	...
885,000	Sept. 19	8	7	British Ord.	135—140	...
100,000	June 3	7	7	Do. 7 p.c. Pref.	140—145	...
350,000	,,	5½	5½	Do. 5½ p.c. 'B' Cum. Pref.	110—115	...
120,000	,,	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...
450,000	,,	5	5	Do. 5 p.c. Red. Deb. ...	100—105	...
450,000	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	90—95	...
100,000	22 May'33	6	4	Cape Town, Ltd.	1—2	...
100,000	6 Nov.'33	4½	4½	Do. 4½ p.c. Pref. ...	1½—3½	...
150,000	June 20	4½	4½	Do. 4½ p.c. Deb. ...	60—70	...
626,860	July 18	6	6	Cardiff Con. Ord.	118—123	...
237,860	June 3	5	5	Do. 5 p.c. Red. Deb.	105—110	...
98,936	Sept. 19	2/-	2/-	Colombo Ord....	1⅞—1¾	...
24,510	,,	1/4⅜	1/4⅜	Do. 7 p.c. Pref.... ...	22/6—24/6	...
739,453	Oct. 10	-/11·48	-/11·48	Colonial Gas Assn. Ltd. Ord.	16/—18/-	...
296,144	,,	1/3·30	1/3·30	Do. 8 p.c. Pref. ...	22/6—24/6	...
1,775,005	Aug. 8	5	5	Commercial Ord.	78—83	...
140,000	,,	—	§13/4	Do. 4 p.c. Red. Pref.	95—100	...
620,000	June 3	3	3	Do. 3 p.c. Deb. ...	72—77	+2
286,344	Aug. 22	5	5	Do. 5 p.c. Deb. ...	113—118	...
200,000	,,	—	§30/2	Do. 3½ p.c. Red. Deb.	97—102	...
807,560	Aug. 8	7	7	Croydon sliding scale ...	136—141	...
644,590	,,	5	5	Do. max. div. ...	100—105	...
620,385	June 20	5	5	Do. 5 p.c. Deb. ...	113—118	...
239,000	Aug. 8	5	5	East Hull Ord. 5 p.c.	95—100	...
186,155	Aug. 8	6	6	East Surrey Ord. 5 p.c. ...	116—121	...
176,211	June 3	5	5	Do. 5 p.c. Deb. ...	112—117	...
250,000	Nov. 7	8	4	Gas Consolidation Ord. 'B' ...	19/—21/-	...
250,000	,,	4	4	Do. 4 p.c. Red. Cum. Pref.	17/6—19/6	...
9,223,324	Aug. 8	5⅜	5⅜	Gas Light & Coke Crd. ...	22⅜—23/3σ	+-/3
2,600,000	,,	3½	3½	Do. 3½ p.c. max. ...	79—82	+1
4,477,106	,,	4	4	Do. 4 p.c. Con. Pref. ...	97—100	...
2,993,000	July 4	—	3½	Do. 3½ p.c. Red. Pref. ...	98—101	...
8,602,497	May 23	3	3	Do. 3 p.c. Con. Deb....	78—82	+1
3,642,770	,,	5	5	Do. 5 p.c. Red. Deb....	110—115	...
3,500,000	,,	4½	4½	Do. 4½ p.c. Red. Deb....	109—112	...
700,000	Sept. 5	3½	3½	Do. 3½ p.c. Red. Deb....	93—98	...
270,466	Aug. 22	6	6	Harrogate New Cons. ...	117—122	...
157,500	Mar. 21	1/2⅜	‡1/-	Hong Kong and China Ord. ...	⅜—1	...
213,200	Aug. 8	6	5⅜	Hornsey Con. 3½ p.c ...	97—102	...
5,600,000	Oct. 24	12	8	Imperial Continental Cap ...	108—113	...
223,130	July 18	3½	3½	Do. 3½ p.c. Red. Deb....	87—92	...
235,242	Aug. 8	8½	8½	Lea Bridge 5 p.c. Ord. ...	162—167	...
63,480	June 20	3	3	Maidstone 3 p.c. Deb. ...	70—75	...
45,000	May 23	†10	†10	Malta & Mediterranean ...	130—135	...
				Metropolitan (of Melbourne)		
392,000	Oct. 3	5½	5½	5½ p.c. Red. Deb.	100—105	...
231,977	Aug. 22	5	5	M.S. Utility 'C' Cons. ...	99—104	...
968,658	,,	4	4	Do. 4 p.c. Cons. Pref.	95—100	...
390,076	June 20	4	4	M.S. Utility 4 p.c. Deb. ...	95—100	...
148,955	,,	5	5	Do. 5 p.c. Deb. ...	113—118	...
125,000	July 1	3½	3½	Do. 3½ p.c. Red. Bds.	95—98	...
675,000	May 9	†6	†6	Montevideo, Ltd.	73—78	...
250,000	Aug. 8	7½	7½	North Middlesex 6 p.c. Con.	142—147	...
396,160	Aug. 8	5	5	Northampton 5 p.c. max. ...	105—110	...
300,000	Oct. 24	†7	†9	Oriental, Ltd.	145—150	...
468,537	June 3	8	8	Plymouth & Stonehouse 5 p.c.	140—150	...
621,667	Aug. 8	8½	8½	Portsmouth & Gosport Cons.	157—162	...
241,446	,,	5	5	Do. 5 p.c. max. ...	100—105	...
73,350	,,	5	5	Do. 5 p.c. Pref. ...	107—112	...
75,000	,,	4	4	Do. 4 p.c. Pref. ...	90—95	...
114,000	Aug. 8	5	5	Preston 5 p.c. Pref.	105—110	...
247,966	June 3	4	4	Primitiva 4 p.c. Cons. Deb. ...	98—103	...
625,959	July 18	4	4	Do. 4 p.c. Red. Deb. ...	94—99	...
15,000	Sept. 5	6	6	San Paulo 6 p.c. Cum. Pref. ...	8½—9	...
441,275	Sept. 19	1/1⅛	1/1⅛	Severn Val. Gas Cor. Ld. Ord.	20/6—22/6	...
460,810	Sept. 19	-/10⅜	-/10⅜	,, ,, 4½ p.c. Cum. Pref.	19/6—21/6	...
133,201	Aug. 22	5	8½	Shrewsbury 5 p.c. Ord. ...	143—148	+16
9,000	June 3	4	‡4	South African Ord.	4½—5½	...
1,371,752	Aug. 22	1/2⅜	1/2⅜	South East'n Gas Cn. Ld. Ord.	21/—23/-	...
871,636	,,	-/10⅜	-/10⅜	Do. 4½ p.c. Red. Cum. Pref.	19/—21/-	...
498,818	,,	4	4	Do. 4 p.c. Cum. Pref. ...	18/—20/-	...
450,000	Aug. 8	4	4	Do. 4 p.c. Deb.	99—102	...
150,000	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	94—97	...
6,709,895	Aug. 8	6	5	South Met. Ord.	103—106	...
1,135,812	,,	6	6	Do. 6 p.c. Irred. Pref. ...	127—132	+2
850,000	,,	4	4	Do. 4 p.c. Irred. Pref. ...	95—100	...
1,895,445	June 20	3	3	Do. 3 p.c. Deb.	75—80	...
1,000,000	July 4	5	5	Do. 5 p.c. Red. Deb. ...	107—112	...
600,000	,,	—	§31/-	Do. 3½ p.c. Red. Deb. ...	97—102	...
1,543,795	Aug. 8	6	6	South Suburban Ord. 5 p.c. ...	113—118	...
512,825	,,	5	5	Do. 5 p.c. Pref.... ...	108—113	...
500,000	,,	4	4	Do. 4 p.c. Pref.... ...	95—100	...
250,000	,,	3⅞	3⅞	Do. 3⅞ p.c. Red. Pref. ...	90—95	...
888,587	June 3	5	5	Do. 5 p.c. Deb.... ...	113—118	...
250,000	,,	4	4	Do. 4 p.c. Deb.... ...	95—100	...
200,000	Aug. 8	3½	3½	Do. 3½ p.c. Red. Deb. ...	94—99	...
427,859	Sept. 19	8⅛	9⅛	S. Western Gas & Water Ord.	16/—18/-	...
160,523	Oct. 10	-/10½	-/10½	Do. 4½ p.c. Red. Cum. Pf.	19/—21/-	...
110,000	June 3	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...
750,541	Aug. 8	5½	5	Southampton Ord. 5 p.c. ...	105—110	...
148,836	June 3	4	4	Do. 4 p.c. Deb.	95—100	...
350,000	Aug. 8	5½	5½	Swansea 5½ p.c. Red. Pref. ...	105—110	...
200,000	June 3	3½	3½	Do. 3½ p.c. Red. Deb. ...	93—98	...
1,076,490	Aug. 8	6½	6½	Tottenham and District Ord.	125—130	...
409,835	,,	5½	5½	Do. 5½ p.c. Pref. ...	116—121	...
62,235	,,	5	5	Do. 5 p.c. Pref. ...	108—113	...
334,615	June 3	4	4	Do. 4 p.c. Deb. ...	95—100	...
85,701	Apl. 25	6	6	Tuscan 6 p.c. Red. Deb. ...	95—101	...
1,131,550	Aug. 22	6	4	U. Kingdom Gas Cor. Ord. ...	17/6—19/6	...
1,051,280	Nov. 7	4½	4½	Do. 4½ p.c. 1st Cum. Pref.	19/—21/-	...
762,241	,,	4	4	Do. 4 p.c. 1st Red. Cum. Pf.	19/—21/-	...
745,263	June 3	4½	4½	Do. 4½ p.c. 2nd Non-Cum.Pf.	15/6—17/6	—/6
1,066,186	Sept. 5	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—98	...
375,689	Aug. 8	7	7	Uxbridge, &c., 5 p.c.	125—130	...
133,010	,,	5	5	Do. 5 p.c. Pref. ...	108—113	...
1,371,138	Aug. 8	7	7	Wandsworth Consolidated ...	135—140	...
2,525,768	,,	4	4	Do. 4 p.c. Pref. ...	95—100	...
1,342,964	June 3	5	5	Do. 5 p.c. Deb. ...	113—118	...
383,745	,,	4	4	Do. 4 p.c. Deb. ...	95—100	...
400,000	,,	—	§25/-	Do. 3½ p.c. Red Deb.	97—102	...
558,342	Aug.	7	6⅝	Watford and St. Albans Ord.	128—133	...
200,000	,,	5	5	Do. 5 p.c. Pref. ...	107—112	...
200,000	,,	5½	5½	Do. 5½ p.c. Pref. ...	110—115	...
200,000	,,	—	16/8§	Do. 4 p.c. Red. Pref.	95—100	...
200,000	June 3	4	4	Do. 4 p.c. Red. Deb.	96—101	...
200,000	,,	3½	3½	Do. 3½ p.c. Red Deb.	92—97	...

σ.—The quotation is per £1 of stock. * Ex. div. † Paid free of income-tax. ‡ For year. § Actual.

Supplementary List and Provincial Exchanges overleaf.

STOCK AND SHARE LIST—Cont.

Supplementary List, not Officially Quoted, London

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Nominal Quotations Nov. 18.	Rise or Fall on Week.
202,152	Sept. 5	5	5	Ascot Ord.	101—106	...
126,182	July 18	5	5	Do. 5 p.c. Pref.	108—113	...
31,035	Aug. 22	–/4⅜	–/4⅜	Associated Utilities 4 p.c. Pref.	16/—18/–	...
100,000	Dec. 13	...	3⅛	Do. 3⅛ p.c. Red. Deb. ...	95—100	...
17,000	Aug. 22	8	8	Bognor Orig. Ord. 'A' ...	155—165	...
62,210	,,	8	8	Do. New Addl. 'A' ...	155—165	...
87,160	,,	7	7	Do. New 7 p.c. max. ...	145—155	...
37,440	Aug. 8	10	10	Cam. Univ. & Town 10 p.c. max.	188—198	...
125,970	,,	7	7	Do. 7 p.c. max.	133—138	...
39,025	,,	5	5	Do. 5 p.c. max.	97—102	...
96,410	July 18	4⅛	4⅛	Cardiff 4⅛ p.c. Pref.	95—100	...
150,000	Aug. 8	4	4	Croydon 4 p.c. Pref.	97—100	...
130,000	June 20	4	4	Do. 4 p.c. Deb.	95—100	...
65,000	Aug. 8	8⅛	7⅛	Eastbourne 'A' 5 p.c. ...	140—145	...
198,000	,,	7	6	Do. 'B' 3½ p.c.	114—119	...
112,312	,,	5	5	Do. 5 p.c. Pref.	107—112	...
130,000	June 20	5	5	Do. 5 p.c. Deb.	112—117	...
24,000	Aug. 8	8⅛	8⅛	Great Yarmouth 8⅛ p.c. max.	43—48	...
59,400	,,	7⅛	7⅛	Do. 7⅛ p.c. max.	33—38	...
51,160	June 3	5⅛	5⅛	Do. 5⅛ p.c. Deb.	121—126	...
152,600	Sept. 5	9	8	Guildford Cons.	163—168	...
54,055	,,	5	5	Do. 5 p.c. Pref.	107—112	...
68,250	June 3	5	5	Do. 5 p.c. Deb.	107—112	...
156,600	Aug. 22	7½	7½	Hampton Court Cons. ...	131—136	...
80,000	Aug. 8	4	4	Lea Bridge 4 p.c. Pref. ...	90—95	...
60,000	,,	6	6	Do. 6 p.c. Pref.	121—126	...
94,876	June 3	4	4	Do. 4 p.c. Deb.	95—100	...
73,620	Sept. 5	8⅛	8⅛	Luton Cons. 'A'	153—163	...
107,960	Sept. 19	5⅛	4	Mid Kent Ord.	8⅛—9⅛	...
230,940	Aug. 8	10	10	Oxford & District Ord. ...	195—200	...
47,112	,,	5	5	Do. 5 p.c. Pref.	106—111	...
50,000	,,	6	6	Do. 6 p.c. Red. Pref. ...	107—112	...
126,193	Nov. 7	7⅛	7⅛	Peterborough Ord.	137—142	...
64,990	Sept. 5	6⅛	7⅛	Redditch Ord....	118—128	...
166,850	Aug. 8	8	8	Romford Ord....	142—147	...
60,000	,,	4	4	Do. 4 p.c. Pref.	98—103	+2
44,000	Sept. 19	5	5	Do. 5 p.c. Deb.	112—117	...
25,570	Aug. 8	5⅛	5⅛	Rugby 5⅛ p.c. Pref.	120—125	...
25,000	,,	6	6	Do. 6 p.c. Red. Pref ...	104—109	...
42,750	June 3	5⅛	5⅛	Do. 5⅛ p.c. Deb.	118—123	...
110,950	Aug. 22	8	8	Ryde Ord.	140—150	...
270,086	Sept. 5	7	7	Slough Ord.	128—133	...
21,000	June 20	5	5	Do. 5 p.c. Deb.	110—115	...
28,872	Nov. 7	5⅛	5⅛	S. Midland Gas Cpn. Ltd Ord.	19/—21/–*	...
28,866	Sept. 5	4⅛	4⅛	Do. 4⅛ p c Red. Cum. Pref.	18/—20/–	...
117,228	Aug. 8	7	5	Swindon Cons.	102—107	...
60,425	June 3	5	5	Do. 5 p.c. Deb.	112—117	...
64,380	June 3	5	5	Torquay & Paignton 5 p.c. Pref.	107—112	...
130,000	Aug. 8	8	5	Wakefield Ord.	116—121	...
81,650	,,	5	5	Do. 5 p.c. max.	100—105	...
82,000	Aug. 8	6	6	Weymouth Ord.	103—108	...
98,384	Aug. 22	6	6	Wolverhampton 6 p.c. Pref.	118—123	...
160,000	June 20	5⅛	5⅛	Do. 5⅛ p.c. Rd. Db.	105—110	...
90,000	June 20	5	5	York 5 p.c. Red. Deb. ...	104—109	...
133,640	July 18	6½	6½	Yorktown (Cam.) 5 p.c. Cons.	118—123	...
120,000	,,	5	5	Do. 5 p.c. Pref.	105—110	...
35,000	June 3	5⅛	5⅛	Do. 5⅛ p.c. Deb.	120—125	...

BRISTOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Nov. 18.	Rise or Fall on Week.
347,756	July 18	6	5	Bath Cons.	117—119	...
1,667,250	July 18	5	5	Bristol, 5 p.c. max.	112½—114½	...
120,420	June 3	4	4	Do. 1st 4 p.c. Deb. ...	100—102	...
217,870	,,	4	4	Do. 2nd 4 p.c. Deb. ...	100—102	...
328,790	,,	5	5	Do. 5 p.c. Deb.	119—122	...
274,000	Aug. 8	5	5	Newport (Mon). 5 p.c. max....	97—99	...
13,200	Sept. 19	9⅜	7	Pontyp'l Gas & W. 10 p.c. 'A'	12½—13½	...
13,600	,,	6	5	Do. 7 p.c. 'B'	11½—12½	...
40,000	,,	6	5	Do. 7 p.c. 'C'	11½—12½	...
140,778	Aug. 8	5	5	Weston-super-Mare Cons. ...	108—110	...
64,338	June 20	4	4	Do. 4 p.c. Deb.	100—102	...
33,340	,,	7½	7½	Do. 7½ p.c. Deb.	151—154	...

LIVERPOOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Nov. 18.	Rise or Fall on Week.
157,150	Aug. 8	6½	5	Chester 5 p.c. Ord. ...	109—111	...
92,500	June 20	4	4	Do. 4 p.c. Pref. ...	95—99	...
36,430	,,	3½	3½	Do. 3½ p.c. Deb. ...	87—90	...
41,890	,,	4	4	Do. 4 p.c. Red. Deb. ...	97—101	...
2,167,410	Aug. 22	6	6	Liverpool 5 p.c. Ord....	122—124	+1
245,500	June 20	5	5	Do. 5 p.c. Red. Pref. ...	100—105	...
306,083	July 18	4	4	Do. 4 p.c. Deb....	100—102	...
106,280	Aug. 8	10	10	Preston 'A' 10 p.c. ...	198—208	...
188,219	,,	7	7	Do. 'B' 7 p.c. ...	131—141	...

NEWCASTLE EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Nov. 18.	Rise or Fall on Week.
122,577	Aug. 8	8	8	Blyth 5 p.c. Ord.	161—163	...
732,000	Aug. 22	5	5	Hartlepool G. & W. Cn. & New	89½—90½	...
2,061,315	Aug. 8	5⅛	5	Newcastle & Gateshead Con.	22/9—22/3a	...
682,856	,,	4	4	Do. 4 p.c. Pref. ...	99—100	...
776,706	June 20	3½	3½	Do. 3½ p.c. Deb. ...	88½—89½	...
277,285	Oct. 24	5	5	Do. 5 p.c. Deb. '43 ...	103½—105½	...
332,351	Aug. 22	6	6	Sunderland 6 p.c. max. ...	135—136	...

NOTTINGHAM EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Nov. 18.	Rise or Fall on Week.
542,270	Aug. 8	9	6	Derby Con.	133—138	...
55,000	June 3	4	4	Do. 4 p.c. Deb.	100—105	...
20,000	June 20	5	5	Long Eaton 5 p.c. Pref. ...	10—12	...
80,000	,,	5	5	Do. 5 p.c. Deb. ...	105—110	...

SHEFFIELD EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Nov. 18.	Rise or Fall on Week.
10,000	Aug. 8	10	10	Great Grimsby 'A' Ord. ...	205—215	...
6,500	,,	10	10	Do. 'B' Ord. ...	205—215	...
79,000	,,	10	10	Do. 'C' Ord. ...	195—205	...
1,806,339	Aug. 22	6½	6½	Sheffield Cons.	140—142	...
95,000	July 4	4	4	Do. 4 p.c. Deb.	101—103	...

a The quotation is per £1 of Stock. * Ex div.

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